THE UNIVERSITY OF ALBERTA

THE INFLUENCE OF TWO TEACHING METHODS ON GRADE ONE AND TWO PUPILS PERFORMANCE IN SELECTED TESTS

by

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A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF ARTS

FACULTY OF PHYSICAL EDUCATION

EDMONTON, ALBERTA

SEPTEMBER 1968

UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "The Influence of Two Teaching Methods on Grade One and Two Pupils Performance in Selected Tests," submitted by David Joseph Sande in partial fulfillment of the requirements for the degree of Master of Arts.

ABSTRACT

The purpose of this study was to investigate the influence of two methods of instruction upon the achievement of grade one and two pupils on a battery of physical performance tests.

Forty grade one and two pupils received instruction by the "direct approach" while another group of forty grade one and two pupils received instruction by the "problem-solving approach".

The subjects were initially tested in September prior to receiving instruction in physical education and finally in April of the next year after having received instruction by the above methods.

The test battery included results from study on the strength testing machine, the strength stool, the stabilometer and the CAHPER fitness performance tests.

Statistical analysis for all items was included as computed by the IBM 7040 which was programmed to calculate the analysis of covariance.

The results were somewhat inconclusive. The grade ones of the sample demonstrated significant difference in two of the eighteen variables both favoring the problem-solving approach group while no significant difference was determined for the remaining parameters. For the grade two subjects of the sample no significant difference between groups was determined for eight variables while ten variables demonstrated a significant difference favoring the direct approach group.

ACKNOWLEDGEMENTS

I am indebted to the members of my committee Dr. W.D. Smith, Dr. R.B.J. Macnab and Mr. N.M. Purvis for their guidance and assistance in the development of this thesis.

My thanks are also extended to the members of the Faculty of Physical Education specializing in elementary school physical education for their suggestions and support.

I wish also to acknowledge my wife Barbara for her patience and understanding during the course of this thesis.

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CHAPTER I

STATEMENT OF THE PROBLEM

Introduction

Educators, parents and pupils are all concerned with the content of the physical education program and the method of instruction used to disseminate the body of knowledge it encompasses. Many authors Carey (19), Glassow (38), Glover (39), Johnson (53), Keogh (56), Kirchner (57), La Porte (58), Lawson (59), H. Morris (66), M. Morris (67) have submitted studies dealing, in varying degrees, with the content and evaluation of an ideal elementary physical education program. In contrast however, is the area of methodology about which a relatively small amount has been written. The importance of method has been taken too much for granted. Brown and Cassidy state, "Method may be thought of as 'how the teacher teaches'". (14:110) If method is important in determining the successful transference of knowledge, then it merits more consideration. At present in Canada there are two distinct methods of approach in teaching elementary physical education: one is the problem-solving method; the other is the direct method. G. Lawrence Rarick in his article, "Exercise and Growth", reported by Patterson and Hallberg, points out that often our programs are not determined through scientifically derived facts, but rather through recommendations based upon experiences. (72:337)

Problem

This study proposed to investigate the level of achievement on a battery of physical performance tests by two groups of elementary pupils. One group received instruction using the "problem-solving approach", while the second group received instruction using the "direct approach".

Subsidiary Problems

The subsidiary problems this study investigated were:

1. The relationship between the problem-solving method of instruction and physical performance.

2. The relationship between the direct method of instruction and physical performance.

3. The relationship between the physical performance tests administered.

Justification of the Study

This study is timely in that currently in Canada there is a general review of educational practices at all levels. A number of articles, books and papers have been submitted by many authorities in the fields of education, psychology and physical education dealing with the effects of movement education programs upon pupils of various ages and stages of development.

Very little research on curriculum content and method has been done at the elementary level. (4:401)

Most studies completed appear only to describe the program offered, survey current practices or report the opinions of experts in the field. (67:7) (4:405)

The importance of the study is emphasized by the present interest of physical educators in the problem-solving approach, and the very noticeable lack of research in the area.

The study may prove of value to educators as a means by which curriculum and method may be evaluated.

Within a chapter on physical education written for the Association for Supervision and Curriculum Development (ASCD) of the National Education Association (NEA) by Delbert Oberteuffer (7:41) some important questions are asked:

1. What shall be taught, when, and by whom?

2. Should teachers assign subject matter to the grade empirically?

3. Are teachers looking at the child and the forces which bear upon him?

4. Do individual variations in the students affect the selection of material to be taught?

Oberteuffer then sums up by writing, "Curriculum makers quite naturally, perhaps, reflect confusion on both the philosophic and operational levels." (7:45)

The Association for Supervision and Curriculum Development further expresses the importance of new insights in the development of the curriculum:

"1. New insights may help us ask new questions.
2. New insights may help us to see new distinctions that need to be made.
3. New insights may lead us to re-examine some of the assumptions on which we have been operating.
4. New insights may help us respond more fully to the things we already understand fairly well.
5. New insights may help us imagine new possibilities."
(6:2-6)

Various provincial curriculum committees are recommending the inclusion of the problem-solving approach of instruction within the elementary school physical education program. (1) (13) (25) (68) (70) (74)

Throughout the years researchers have developed and improved methods and techniques in quantifying physical performance. However, few attempts have been made to relate achievement or performance with method of instruction at the elementary school level.

Limitations of the Study

The investigation was limited as follows:

1. Only subjects who were registered pupils in either Windsor Park or Grandview Heights Elementary Schools, City of Edmonton Public Schools, in grades one or two comprised the sample.

2. The groups were not selected at random but were made up of one class of grade one pupils and one class of grade two pupils at Windsor Park Elementary School who received instruction by the problem-solving method; and one class of grade one pupils and one class of grade two pupils from Grandview Heights Elementary School who received instruction by the direct method.

3. Each chosen class in each of the schools received instruction by a separate instructor. Instruction by the direct method was delivered by the regular classroom teachers of the subject's at Grandview Heights. Instruction involving the problem-solving approach was presented to the pupils at Windsor Park Elementary School by two specialists in elementary education from the University of Alberta.

4. Tests were administered during one week of September, 1966 and during one week of April, 1967.

5. Each group was tested within its own school area.

6. The order in which various subjects were tested varied from one test to the next.

7. No pupils who were certified by a school nurse or an administrator as suffering from a physical handicap or an illness were tested.

8. Testing was administered by a team of eleven examiners.

9. No attempts were made to determine the attitudes of the subjects toward their respective programs.

10. The subjects from Windsor Park Elementary School registered in grade two have had previous experience with test items of the study by participation in a laboratory pilot study.

11. The following tests were administered in the assessment of physical performance:

A. The Strength Chair (46:4) administered in the following order:

(a) right grip strength

(b) left grip strength

(c) right elbow flexion

(d) left elbow flexion

(e) right elbow extension

(f) left elbow extension

(g) right knee extension

(h) left knee extension

B. The Strength Stool (46:4) administered in the following order:

(a) leg lift

(b) back lift

C. Stabilometer (20:43) 20 trials of 30 seconds duration.

D. C.A.H.P.E.R. Fitness Performance Test (18:22) administered in the following order:

Day one: (a) one minute speed sit ups

(b) standing broad jump

(c) shuttle run

Day two: (d) flexed arm hang

(e) 50 yard run

(f) 300 yard run

12. The investigation was further limited by the statistics employed in analysis.

Definition of Terms

1. Physical performance. The measurement of the accomplishments of a subject in selected activities.

2. Method. The systems and procedures followed in teaching physical education.

3. Problem-solving approach. A means of instruction in physical education involving the solution or expression of problems or themes as they are interpreted by the individual student, also commonly referred to as movement education.

4. Direct approach. A means of instruction in physical education whereby students follow teacher-assigned problems and their specified solutions.

5. Elementary School or Primary School. A school including grades one through six.

Hypothesis

In the problem the null hypothesis states that the mean variance differences in physical performance test results of the two test groups at the conclusion of the final test period will be equal.

Alternate Hypothesis

The alternate hypothesis states that the mean variance differences in physical performance test results of the two test groups at the conclusion of the final test period will not be equal.

CHAPTER II

A REVIEW OF THE LITERATURE

Introduction

Bruner, early in his book, "The Process of Education", clearly states what he considers to be one of the major questions in education today; "what shall we teach, and to what end?" (15:1) Later in the same book, while discussing readiness and learning, the author states:

> "we begin with the hypothesis that any subject can be taught effectively in some intellectually honest form to any child at any stage of development . . . . The task of teaching a subject to a child at any particular age is one of representing the structure of that subject in terms of the child's way of viewing things." (15:33)

Recognizing completely the very close association of content and method, this review of the literature will be concerned primarily with the method of instruction, although further problems in curriculum development have been outlined by the question asked about curriculum revision by the Association for Supervision and Curriculum Development:

> "How does the development fit the total program? Curriculum generalists must be especially concerned with the impact of new developments on the existing program. Will the new development crowd out other more worthwhile curriculum experiences? Can it properly replace existing materials or emphasis? How will this development affect the school day, week or year so as to make possible a meaningful, balanced program for the individual student? How would the innovation affect the continuity of the program now and in the forseeable future?" (7:10)

The remainder of this chapter will review the present conditions with reference to physical education as seen in: methods and

curricula; Canadian elementary physical education; the influence of related studies and a summarizing statement.

Methods and Curricula

Allenbaugh (3:48) has outlined the stages of physical education's development within the past years as: a participation stage, a socializing stage, a physical fitness stage and a new trend the movement stage.

Five major influencing factors put forward by Percy Jones (55:27) for the change in methodology are worthy of note here:

> "1. Our own dissatisfaction with the traditional work and its limited appeal to so many boys.
> 2. The tremendous success of the less formal approach developed in Primary Schools.
> 3. General trends in modern education with its emphasis on the needs of the individual.
> 4. The comments and criticisms of School Inspectors, Educationists, Teachers, Parents and others.
> 5. The reaction, response and enthusiasm of the boys themselves."

These factors represent some rather common pressures which may lead educators to concern about current programs and to provide suggestions for revision. M.W. Randall (76:22) wrote of the feeling that lessons were too rigid and that a more informal approach would lend itself more to individual coaching and encouragement as contrasted with group teaching.

Mildred Lemen (60:72) warns the physical educator that the problem solving approach may take more time than a more direct approach, but, the advantage is that it is also more rewarding.

Williams (88) believes the creativity aspect is the only way of discovery or advance in areas of government, business, education, science, industry and society. To a less apparent degree the same may also be true with the pupil in his "discovery experiences" as he experiments to determine the capabilities and capacities of his body.

An area which is not new but which by its very method has contributed to the development of movement education, is the problem solving movement. Examples of its application have been put forward by a number of authors. Halsey and Porter (42:176-177) outline the method problem solving would take in movement education as: "(1) setting the problem; (2) experimentation by the children; (3) observation and evaluation; (4) additional practice using points gained from evaluation."

Hudgins (48:iv) speaks of problem solving as more of an attitude than a method, and is quoted from his book "Problem Solving in the Classroom", as writing:

> "Problem solving is not a method of teaching . . . . It is a general attitude, a disposition toward inquiry which has as its goals the development of new ideas based upon older ones and the seeing of intellectual light where darkness lay before."

The importance of an environment conducive to enquiry without fear of rebuke or undo criticism and where a "real purpose" in learning is apparent is the best media in which to engage in problem solving. (9:81)

One of the most striking influences of problem solving has been the emphasis physical educators have placed upon consideration of the

individual. Caudwell (23), (24), Cooper (27) and Dennison (33) all emphasize this point in the following extractions from their articles.

Caudwell (24:10) writes:

> "When considering the physical education programme our first thoughts should be directed towards what the child can already do."
>
> "Today, educators believe that greater consideration should be given to the education of the individual within the group."
>
> ". . . emphasis should be laid on each individual making progress at his own rate."

In a further article Caudwell (23:9) lists four points justifying educational gymnastics:

> "1. The lessons provide vigorous well balanced physical activity for all parts of the body.
>
> 2. The lessons provide activity where each student can work at his own rate and within his own ability without fear of failure. At the same time more able students can be extended to the maximum.
>
> 3. The students are learning fundamentals of movement and they are encouraged to use what they have learned in a variety of situations.
>
> 4. Students develop self-confidence, initiative and independence and this is particularily evident when observing the progress of the less able pupil in the class."

N.C. Cooper (27:20) states: "Of the many situations within the scope of physical education, one facilitates the desired educative responses the easier. This is Educational Gymnastics or body management."

J.D. Dennison (33:41) takes a similar but more conservative approach by recommending:

"It might appear that the indirect teaching method is the complete answer to all instructional problems. Should such an impression be created, a word of caution seems appropriate. . . It is the writers opinion that, just as there is no one way to performaa skill, there is no one way to teach."

When looking at the English scene one sees a very high degree of involvement by physical educators in the Primary Schools toward the movement education approach. The London County Council (61) (62) has published books based upon Laban's principles for gymnastics and movement. Mauldon and Layson (63) are authors of a basic gymnastic text, while Joan Russell (77) a member of the Laban Art of Movement Guild is the author of a book on creative dance. Howell and Van Vliet (47) report physical education in Britain's Primary Schools as follows:

"Primary Schools: Physical education is based on natural activities such as throwing, running, leaping, crawling and climbing. Small apparatus, such as balls, ropes and hoops is used extensively, accompanied by an increasing use of climbing-apparatus. Minor playground games and informal sessions of national games are popular. Folk-dancing has diminished in use and dance of a more imaginative variety is being introduced. Wherever facilities permit, swimming is included in the curricula of the upper class. One period a day is usually set aside for physical education, with the class teacher as instructor."

Not all the concern for method of instruction has been expressed during the last few years. In a book published in 1939 by Jackson K. Sharman, he expresses the influence of the progressive educationists upon physical education when he writes:

"In physical education there has been much discussion during the past decade as to the comparative effectiveness of the formal and informal methods of presenting material . . . There is not a great deal of evidence available on the comparative worth of these two methods." (80:114)

The A.A.H.P.E.R. publication "This is Physical Education" (5:24) points out,

> "In physical education, too, children are now dealing with the concepts, symbols, and skills of movement experienced in ways that could not have been foreseen a generation ago. Today's physical education is the subject in which children learn to move as they move to learn."

A number of American authors including Clark (26), Cratty (29), Gray (40), Howard (44) and Jenkins (52) all stress the importance of the child centered program as Jenkins (52:36) writes, "Today emphasis is shifting from competitive achievement toward self-achievements."

Another area of some emphasis in both teacher and child centered (emphasis on child centered) programs is that of movement exploration. Fait (35), Hacket (41) and Pearson (73) all include areas discussing procedures in movement exploration and with slight variations would expound the virtues similarily to those of the Detroit Public Schools who write:

> "Exploration is too often conceived as an undisciplined activity filled with aimless ineffective motions. The teacher must be convinced that it is a dynamic sustaining form of learning and must provide the children with a progressive series of movement problems which challenge them and lead to greater skill and mastery of a variety of ways of moving.
>
> The child when probing, exploring, experimenting, and inventing, develops for himself the basic principles of how his body can move. Through further investigation he discovers how to vary and control these movements. Finally, he translates his knowledge into other areas of activity - games, dance and work." (34:21)

According to James Humphrey, "The term 'method' might be considered as an orderly and systematic means of achieving an objective. In other words, method is concerned with 'how to do' something in order to achieve desired results." (49:67) R.W. Webster reiterates Humphrey's definition by writing, "In ordinary usage, method carries the connotation steps. It is a specific and orderly procedure employed in accomplishing something." (87:199) Webster concludes his discussion of method by defining "The best method or methods are the ones that bring about the best results, the hoped-for objectives, the desired changes in students' awareness, habits, skills, knowledge and behaviour." (87:203)

Bruner emphasizes the decided need for research when he states, "There is a surprising lack of research on how one most wisely devises adequate learning episodes for children at different ages and different subject matters." (15:49)

Louis E. Alley states, in an A.A.H.P.E.R. published text edited by Gladys Scott, that the most common procedure for attempting to determine grade placement of activities has been to utilize the opinion of experienced teachers. (4:405) Recognizing the obvious value in such decisions, G. Lawrence Rarick concurs with Alley in his opinion, as is illustrated by his comments previously recorded but repeated here for emphasis: "Much remains to be learned concerning the effects of exercise on human growth. At the present time recommendations concerning exercise programs for children are based primarily on experience rather than scientifically derived facts." (72:337)

The solution to the problems of curriculum development as seen by Brown and Cassidy is presented as: "The process of program change or development advocated in this book is one of planned change - a scientific and creative process." (14:22)

The value of the sequencing of course content, is recognized as important by Taba, who writes:

> "Often the curriculum is ineffective not because its content is inadequate but because it is put together in a way that makes learning difficult, or because learning experiences are organized in a way that makes learning either less efficient or less productive that it might be. (85:290)

will not be of primary concern in this study.

Scott illustrates the dilemma of the curriculum developer by pointing out, "Curriculum problems are broader and less clearly defined than are the problems of 'pure' research." (4:397)

Jones et al (54:9) explains,

> "Teaching methods in physical education are based on the established principles that govern teaching in all subject matter areas. Establishing a background of experience before introducing a medium of expression has proved its worth in physical education as well as in reading. Basic skills must be thoroughly developed before they can be satisfactorily applied in the more complex situations of which they are component parts."

With respect to curriculum development, Blanchard indicates in a book written by him in 1942,

> "Some curricula have been developed with the selection of content based solely upon the interests of the child. This is a mistake just as it is a mistake to disregard the interests of the child entirely." (11:58)

Later in this discussion, Blanchard suggests:

> "Materials should be chosen with reference to children's activities, to their growth characteristics to school organizations, to scientific knowledge, to facilities and equipment, and to past experiences." (11:58)

A number of authors: Morison (65:10), Caudwell (23:7), (24:11), Carson (21) and Bilbrough (8:13) emphasize the necessity of physical educators and curriculum revisionists considering the needs and abilities of the individual. All suggest the acceptance of a program which allows the child to work at a level which is appropriate for him.

Movement education is not without its critics, and many noted scholars are advocating an approach ranging from a "slow-down and take a good look approach" to a "throw-out the nonsense idea." Sedgwick (78:7) reports that A.D. Munroe was particularily concerned about:

> "1. Is movement education to be the fundamental approach to all forms of skills, and is the aim to introduce the terminology into coaching and teaching as a language of kinaesthesis?
>
> 2. Is the pursuit of the other skills in education curtailed, extended or untouched by the introduction of basic movement?
>
> 3. Can the importance of mobility, strength and endurance be disregarded? If specific attention is not directed to these, does it mean that they will look after themselves?

Simons (81:7) speaks of several "abuses" he forsees:

1. The method may be substituted for a teacher's ability and knowledge of a skill.

2. Children develop many specific movements which can not be used competitively or recreationally.

3. The field has been invaded by egotists looking for a "short-cut" to an administrative position. Wiseman (89:19) hopes that "we abandon a consideration of general movement factors and proceed instead to a lively discussion and experimentation with methods of achieving skills." This suggestion is of course based upon the analysis of research finding high specificity of skill and little transfer of learning. Wiseman concludes by writing:

> "Movement Education - What it is and what it is not depends on the teacher. It could be new content for physical education or simply new teaching method or a combination of both." (89:20)

The key to advanced skill development is understanding. A statement supporting this theme appeared in A.A.H.P.E.R.'s publication "This is Physical Education", where the authors state, "... the better man understands what he is trying to do, the better he is able to do it." (5:24)

In summarizing the attitude taken toward method, Webster (87:20) states, "The best method or methods are the ones that bring about the best results, the hoped-for objectives, the desired changes in students' awareness, habits, skills, knowledge and behaviour."

Dauer (31:6) gives similar counsel by suggesting,

> "The enterprising teacher will teach the child by the most suitable method, either direct or indirect as the case may be. Even within a single lesson, part of the activities can be presented by one means and the remainder by the other. It would seem inconsistent logic for some to hold that one method is entirely suitable to the exclusion of the other. No matter what the method, the child should be the center of the lesson."

Canadian Elementary Physical Education

Carson and Leiper (86:108-109) sum up two of the factors influencing curriculum development in Canada as

1. a combination of the use of American texts and ideas and
2. the influence of the English approach to physical education as observed by Canadians visiting Britain or as practised by English teachers in various Canadian schools.

Oberteuffer (7:46), when referring to the trend of physical education in the United States stated, "In 1963 it is apparent that the principal theme throughout the area is that of fitness." Today in Canada as in the United States fitness is still of prime concern as is illustrated by the current emphasis across Canada for participation in the Centennial Athletic Award Program and the widespread use of the CAHPER Fitness-Performance Test Battery.

Presently a number of physical educators including Carson (21), Caswell (22), Cooper (27), Dennison (32)(33), Howell and Van Vliet (47), Sexton (79) and Van Vliet (86) have to varying degrees advocated a very extensive re-evaluation of Canadian physical education programs at the elementary level. The post-war fitness drive is still very important as seen by the interest shown in the Centennial Fitness Testing Program which is being carefully examined with reference to the child. Though a predominance of the current literature advocates (at least to some Extent) the movement education approach, a study of Provincial Curriculum Guides does not show this same emphasis. The lag so common between research and

curriculum implementation is very apparent in the curriculum guides of many Canadian provinces (1), (2), (12), (13), (25), (30), (68), (70), (74), (75) and (84). Many provinces including Alberta, British Columbia, Ontario, Prince Edward Island, Nova Scotia and New Brunswick advocate some work in the area of movement education but little actual assistance is given through the guides with the exception of Alberta and Ontario. Many guides are still badly out-dated and ill-prepared to meet the needs of children entering Canada's second century.

Related Studies

An indirect matter influencing program reassessment were the results of the comparative tests of physical fitness of British and United States children (17:11-13). The items children aged ten to seventeen were tested in included: pull-ups (modified for girls), sit-ups, shuttle run, 50-yard dash, standing broadjump, softball throw and 600-yard run-walk. The test (although criticized for methodology in administration and sampling techniques) showed the British boys and girls to be superior in all items except the softball throw. Even though such results might be questionable, the overwhelming difference caused many physical educators to ask the question - why such a discrepancy?

Another sample of approximately 8,000 children of grades five through twelve on the same items as the 1958 study but substituting a flexed arm hang item for the girls modified pull-ups showed an improvement in the physical fitness level for the American children. (50:72)

Glover investigated several physical fitness test items for grades one, two and three pupils. She found the reliability of broad-jump to be .83, jump and reach .61, modified pull-ups .75, seal crawl .82, shuttle run .86, 30 yard dash .70, and sit-ups .84. Glover concluded, "These items, measuring physical fitness achievement show evidence that the primary grade child is quite capable of taking such tests." (39:67)

A two year program of vigorous physical education was compared with that of a control group over the same period by Glassow, Halverson and Rarick (38), and yielded some interesting results:

1. In the three fundamental skills, run, jump and throw, the experimental group means were consistently better than those of the control groups in the run; there was no consistent difference in the jump and throw.

2. In the physical fitness measures taken as a whole, the experimental group scores were superior. However, these must be viewed with caution since there were many differences in the methods of measuring.

3. In strength scores, the experimental program generally resulted in greater gains than did the previous program. The superiority is clearly evident in the muscle groups of the lower extremities and less clearly defined in the upper. The gains were greater for the younger children than they were for the older.

Keogh (56) used running, jumping, throwing, hopping and balancing items in a battery used to measure the motor performance of 1171 elementary school children from kindergarten through grade six.

A comparison of the Lincoln revision of the Oreretsky Tests of Motor Proficiency with the Iowa revision of the Brace Test, the Metheny revision of the Johnson Test, and the Cowan-Pratt test by Carey (19), who used Pearson products moment "r" to examine the relationship between these tests and their relationship to grade, age, height, and weight found low intercorrelations; and a low "r" between the Iowa-Brace and Metheny-Johnson as they related to grade, age, height and weight.

Johnson (53) administered achievement tests in fundamental skills to 2,459 boys and 2,195 girls in elementary school to establish norms for each of the related skills. The areas he covered were kicking, pass and catch, agility run, jump and reach, and batting.

A study to investigate the effects of the use of selected pieces of playground equipment on the arm and shoulder girdle strength of elementary school children was carried out by Margaret Morris (67). The subjects chosen were grades one to three pupils whose age ranged from six to eight years. The group using playground equipment showed significant gains in strength as measured by a right and left grip test, push and pull test, vertical pull test, bent arm hang and flexibility measures,

In a paper presented to the American College of Sports Medicine by Howell and Alderman summing up many batteries of physical fitness tests and referring to the use of these human performance tests they say:

"..., there is a distinct disagreement between those espousing generality and those supporting specificity. Our own conclusions are in line with the specificity concept, and like Adams believe that the future lies in the ultimate prediction of performance curves for individual subjects.

Despite this, one must be realistic and recognize that there are values in such tests - they at least provide us with population norms on certain physical performances, and as long as their limitations are realized they may be used as motivating devices. As tests of certain physical performances they are at the least useful." (45:5)

Summary

A major influence leading to the introduction of at least some aspects of movement education has been the idea that the program should be more child centered in its approach. A sample of those persons whose writings contain references to a more informal approach placing more emphasis on teaching situations applicable to the individual are; Bilbrough and Jones (8), Cameron and Pleasance (16), Irwin (51), Morison (65), Passmore (71), Hope Smith (82) and Paul Smith (83). Such ideas were of course contradictory to the highly organized and teacher directed approach in the instruction of games advocated by: Blanchard and Collins (10), Blanchard (11), Cowell and Hazelton (28), Jones, Morgan and Stevens (54) and O'Keefe and Fahey (69).

Heath points out some of the difficulties inherent in a study such as this by arguing:

"... formally designed experiments pitting one course against the other are rarely definitive enough to justify their cost. Differences between average test scores resulting from different courses are usually small, relative to

> the wide differences among and within classes taking the same course. At best, an experiment never does more than compare the present version of one course with the present version of another. A major effort to bring the losing contender nearer to perfection would be very likely to reverse the verdict of the experiment." (43:237)

Heath further states:

> "It is thus never certain whether any observed advantage is attributable to the educational innovation as such, or to the greater energy that teachers and students put forth when a method is fresh and 'experimental'. Some have contended that any course, even the most excellent, loses much of its potency as soon as success enthrones it as 'the traditional method'". (43:237)

The warnings of Heath must be kept in mind, however, the demands for further examination in the area of elementary physical education justify the pursuit of this study.

CHAPTER III

METHODS AND PROCEDURE

Selection of the Subjects

The subjects were boys and girls registered in grades one and two at Windsor Park Elementary School and Grandview Heights Elementary School. The Edmonton Public School Board consented to permit the testing of the grades one and two pupils in the schools selected. The principals and teachers of the pupils involved in the study were visited prior to the test period to arrange scheduling to minimize disruption of the regular school schedule by the testing team. Classroom teachers provided lists of students registered in their home rooms.

Time and Duration of the Study

The study was divided into two test periods. The first test period was the second week of September, 1966, when two days were spent by the team of investigators in each of the two schools. The final test period was during the third week of April, 1967, and as in September, two days were spent examining the subjects in each of the two schools.

Description of the Apparatus

Strength Testing Machine. (46:51) (Illustration I and II) The strength testing machine, which was designed by Hettinger and modified by Howell, was used to measure eight strength items of the physical performance battery. The strength machine was composed of a six foot long vertical

cylinder mounted on a heavy metal base. Mounted over the top of the cylinder was a fitted sleeve which had two horizontal pipes welded to form a V. This V bar was used to attach a chain during the elbow extension tests. A toy tractor seat was attached to the main cylinder by an adjustable collar which allowed the seat to be manipulated for subjects of unequal size. A web belt was used to secure the subject to the seat. Above the seat and also attached to the main cylinder by a collar which could be raised or lowered by cranks was the back support which had horizontal arms from which two elbow holders were arranged. These elbow holders were totally adjustable by a sliding mechanism which could be tightened in the required position to stabilize the arms vertically and laterally. Also attached to these horizontal arms were two shoulder stabilizers to prevent shoulder lift and body rotation. The base of the machine contained a number of adjustable hooks to which chains could be attached for the elbow flexion and knee extension tests. Auxiliary equipment required for the strength machine included various short chains, assorted lengths of precision cables, web belt loops and hooks, a Pacific Scientific cable tensiometer and a goniometer. (Illustration IV)

The grip strength tests were also performed on the strength machine. A Smedley adjustable grip dynamometer was used to record grip strength scores.

Strength Stool. (Illustration III) The strength stool apparatus which was used to examine leg and back lift was composed of a low and heavily

constructed stool that the subject could stand on. Attached through the top of the stool was a bolt to which cables could be attached. Other equipment included: a two foot long metal bar with grips on either end and a hook to attach cables in the center, a web belt to secure the bar during the leg lift, a Pacific Scientific cable tensiometer, a goniometer and assorted lengths of short chains and precision cables.

Stabilometer. (Illustration XII) The stabilometer is an instrument consisting of a one inch plywood platform forty-eight inches long by twenty-four inches wide, on which were fixed two eighteen and one-half by twelve inch rubber mats. Steel rods from the center of the platform were attached to supporting steel uprights which were attached to a heavy steel base. This arrangement allowed the platform to pivot about a center of rotation ten inches above the platform. This rotation of the platform was provided for by pillar blocks mounted on the supporting uprights. The range of rotation of the platform was 20° from the horizontal. The motion of the platform was recorded in electrical movement units equivalent to 1° movement. The electrical recording was provided by a segment of forty circular contact points with carbon brushes which provided electrical impulses with the back and forth movement of the platform. These impulses were recorded on an electrical counter. Also involved within the mechanism was an electrical timer which was wired in series in such a way that when the platform was resting against the supporting base, no time elapsed. The electrical timer and counter were controlled by means of a microswitch.

Descriptions of the Tests

Prior to the commencement of actual testing, the two classes in each school chosen to be tested were assembled in the test area and introduced to the team of examiners who briefed the subjects on the procedures to be followed in each item of the performance battery.

Strength Machine Tests

The tests were given in the following order:

1. Grip Strength Test. (Illustration VI) Each subject was secured in the strength machine (commonly referred to as "the chair") by a web belt around his abdomen, the shoulder pieces over the shoulders and the elbow supports behind the elbows. The subject was then asked to flex his right arm to the maximum. He then grasped the Smedley Adjustable grip dynamometer. He was instructed to lower his forearm to 90 degrees while squeezing the grip as "hard as he could" without rotating his hand. Verbal encouragement by the shout technique was given during the six second trial. While the first of three trials was being recorded by the examiner or his assistant, the subject was given a brief rest. Following a total of three such maximal right hand squeezes the same procedure was carried through in testing the left hand grip strength.

2. Elbow Flexion Test. (Illustration VII) The subject's shoulders were carefully secured by the shoulder pieces, so that the shoulders were balanced horizontally, the elbow holder was checked to assure the upper arm was vertical. The chain and cable assembly was hooked to the

base of the strength machine, and a web loop with a hook was placed around the subject's forearm midway between the wristbone and the olecranon process, with the hand held in a clenched and vertical position. The snap of the web loop and the cable were connected directly below the arm so that the pull was perpendicular and the angle of the elbow as measured by the goniometer was 120 degrees. The Pacific cable tensiometer was attached to the cable, and the subject was instructed to flex his arm against the taut cable for six seconds. As was done during the grip test, the subject was encouraged by the shout technique to perform a maximal contraction. A short rest was given while the tensiometer value was recorded. Following three maximal contractions of the right arm, this procedure was duplicated for the left arm.

3. Elbow Extension Test. (Illustration VIII) The subject's body and arms were stabilized in a position similar to that used in the previous test. The chair and cable assembly was attached to the V bar on top of the main cylinder in such a position that, when attached to the web loop surrounding the subject's forearm, the pull was perpendicular. The goniometer was used to establish an angle of 90 degrees at the elbow. The subject was instructed to push his clenched hand (not his arm) toward the floor during a maximal contraction of six seconds. Upon completion of the testing of the right arm, the left arm was examined, similar procedures being used.

4. Knee Extension Test. (Illustration IX) The subject remained in the strength machine and placed his hands, palms down, upon his thighs. The chain and cable assembly was attached to a hook near the rear of the

heavy base in such a position as to cause an angle of 120 degrees to be formed when attached to the web loop positioned midway between the knee bone and the malleolus of the subject's right lower leg. The examiner positioned his hand as a target just in front of the subject's foot and instructed the subject to kick toward his hand. The target prevented the subject's leg from varying off the proper alignment. Upon completing three maximal contractions with the right leg, the subject repeated the same procedure with the left leg. The knee extension test represents the last test on the strength machine.

Strength Stool

The order of testing on the strength stool for all subjects was as follows:

1. Leg Lift Test. (Illustration X) The subject stood upon the stool, which was placed against a wall, with his feet placed shoulder width apart and astride the bolt to which the chain and cable assembly was attached. The examiner requested the subject to grasp the metal grip bar with one hand prone and the other supine. The subject was then asked to flex his knees slightly to form an angle of 120 degrees as measured by a goniometer. A web belt was looped over one end of the metal grip bar and passed around the subject's waist just above the hip bones to the other side where it was secured. A Pacific Instrument Cable tensiometer was attached to the cable, and the subject was then asked to attempt to straighten his flexed legs. The subject was encouraged by the shout technique to resist the cable for a period of six

seconds. A brief rest was allowed while the examiner recorded the subject's score. Similar procedures were followed for a total of three maximal contractions.

2. Back Lift Test. (Illustration XI) The subject remained upon the strength stool. The examiner removed the web belt from the metal grip bar and instructed the subject to lock his knees and bend forward slightly from the waist. The subject was then asked to round his shoulders and grasp the bar, one hand in the prone position and one in the supine. Upon a signal from the examiner the subject attempted to press his back against the wall by pulling against the cable. Three maximal contractions were performed by the subject to complete the testing on the strength stool.

CAHPER Fitness Performance Tests

The six items of this battery were administered as suggested by Hayden and Yuhasz. (18:8-22) Two days were allocated for the testing within each school, with three items examined on each day. The shout technique of encouragement was used throughout.

Day One

1. One Minute Speed Sit-ups. The examiner and his assistant instructed the subject in the procedure to be followed in executing a complete sit-up. In this exercise the subject assumed a supine position on a gymnasium mat with his fingers interlocked behind his head and with his knees bent and feet flat on the mat. The assistant straddled the subject's feet and grasped the subject's calves just below the knees,

thus stabilizing the subject's position. The examiner signaled the subject to begin his series of sit-ups and simultaneously started his stop-watch. The assistant examiner counted the completed sit-ups. One maximal trial of one-minute's duration was allowed.

2. Standing Broad-Jump. The subject was instructed in the proper technique for executing a successful broad jump by the examiner, who advised him to take a position behind the take-off line with bare feet slightly apart. The subject was directed to bend at the hips, knees and ankles, and by vigorously swinging the arms, to jump from a two foot take-off as far as possible. Two or three practice jumps were allowed. The measured trials were executed on a polyethylene mat which had been marked off in one inch intervals. The assistant examiner checked the take-off line to determine whether or not the jump was legal, while the examiner checked the landing and recorded the distance to the nearest inch. The maximum of two trial jumps was recorded as the subject's broad-jump score.

3. Shuttle Run. The examiner marked the course by placing two lines of masking tape on the gymnasium floor, thirty feet apart. At the line opposite the starting line two wooden blocks (two inches by three inches by three inches) were placed. The barefoot subject was instructed to lie prone, hands palms down, at shoulder level, resting on the floor and with his forehead on the starting line. On a signal "ready; go" the subject jumped up and ran as quickly as possible to the opposite line; picked up one block, returned, and placed it across the starting line and returned to bring back the other block. Time was measured to the

nearest tenth of a second from the time the subject was instructed to "go" until his chest crossed the finish line. The better of the two trials was recorded.

Day Two

1. Flexed Arm Hang. A doorway gymnasium bar was placed at a height of six feet above the floor by the examiner. The subject was instructed to grasp the bar with his palms facing him and to support himself for as long as possible with the bar at eye level. The assistant examiner raised the subject to the bar and released him on the examiner's signal but remained in position to catch the subject when he had dropped below eye level with the bar. During one trial the examiner counted out the seconds as they elapsed and recorded the total time to the nearest second.

2. 50 yard Run. A 50 yard straight away was limed on the playground area of each of the two schools. A four foot flagpole was placed at each end of the run to provide a visual objective to the runner. The subject was instructed to run from the start to the finish of the course as quickly as possible without leaving the limed area. All subjects wore running shoes. The starter gave the signal "ready; go", and simultaneously signalled the start by dropping his arm. The examiner started his stop-watch on the starter's signal and stopped it as the runner's chest crossed the finish line. Time was recorded to the nearest tenth of a second.

3. 300 yard Run. The 300 yard run was administered to the subject over the same course as was used to measure the 50 yard run. The examiner

advised the subject of the number of circuits of the area (three) and asked him to run as near to the limed line as possible and to try to run the entire distance. The examiner advised each subject of the number of circuits to be completed, and timed each to the nearest second. The 300 yard run marked the completion of the CAHPER Fitness Performance battery.

Stabilometer. (Illustration XIII) The examiner explained to the subject that the objective was to stabilize the stabilometer at the horizontal position. The subject was told he should keep the stabilometer as quiet as possible as the "clicks" referred to errors of movement. The subject was instructed to mount the deck of the stabilometer facing away from the electric counter and timer with his feet shoulder width apart, and his weight over his right foot and with his hands placed upon his hips. The subject was given a signal, "ready; go", at which time he attempted to bring the deck to the horizontal and keep it as near that point as possible for a period of 30 seconds. The examiner recorded the total accumulated degrees of error every five seconds. Upon reaching 30 seconds, the subject was commanded to stop. His total number of errors in degrees of movement were recorded. The subject rested 30 seconds before his next trial. Each subject completed twenty 30-second trials. During the September, 1966, test period due to an insufficient amount of time available for testing, only one half of each group was tested while the entire sample was tested during the April, 1967 test period.

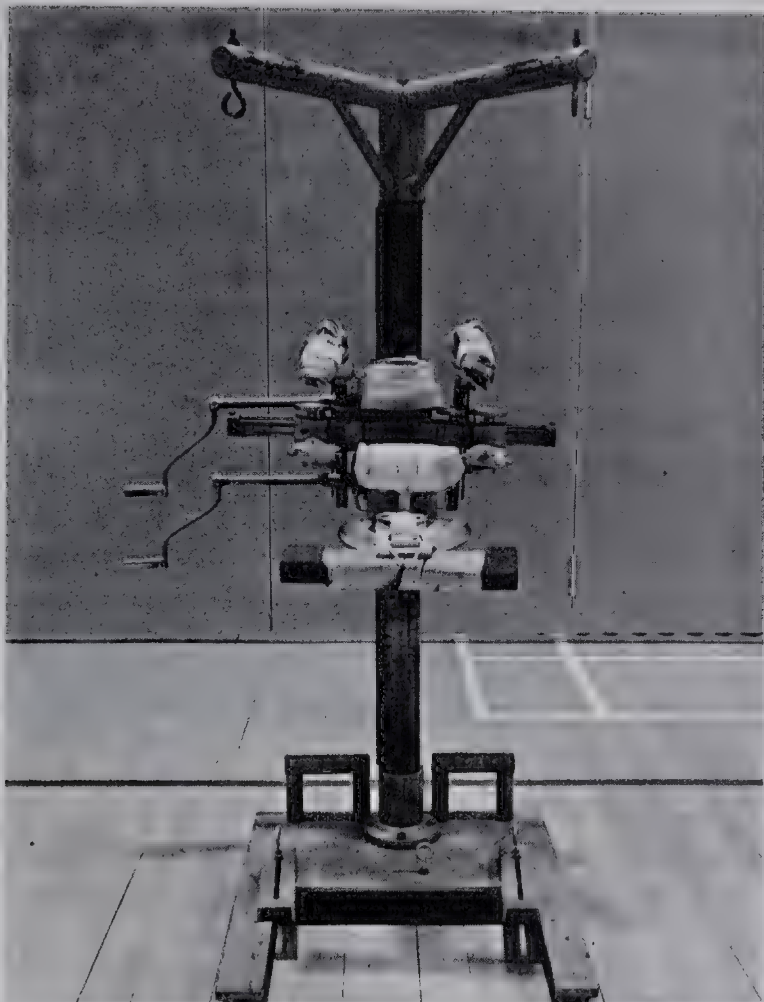


ILLUSTRATION I STRENGTH TESTING MACHINE - FRONT VIEW

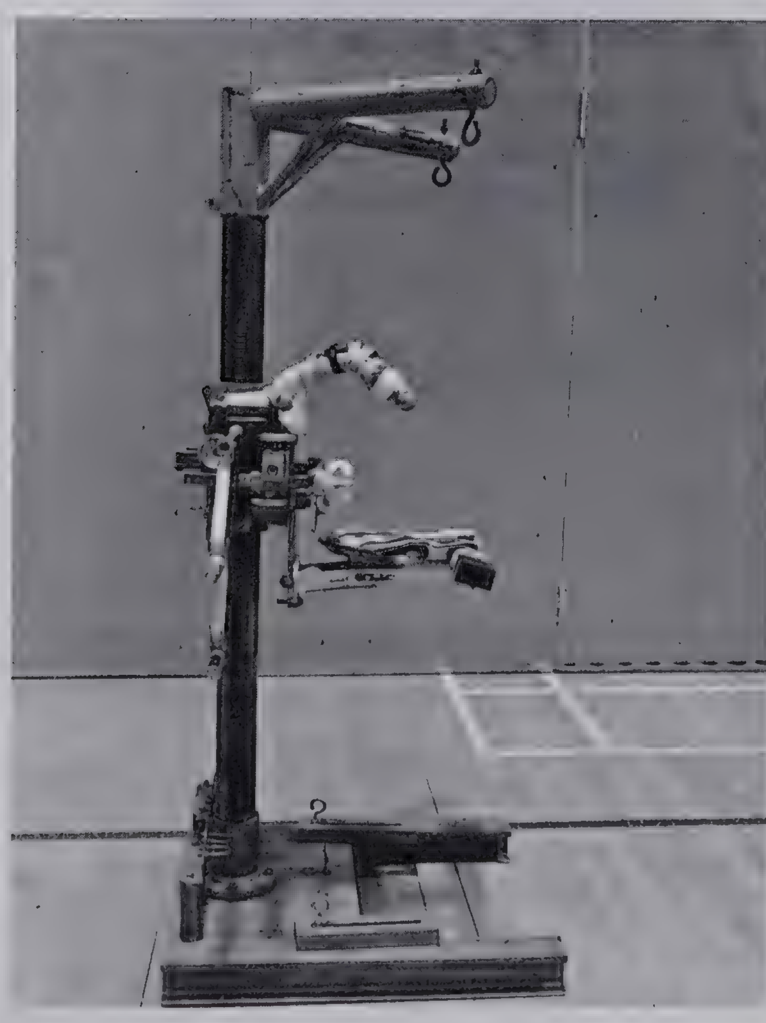


ILLUSTRATION II STRENGTH TESTING MACHINE - SIDE VIEW

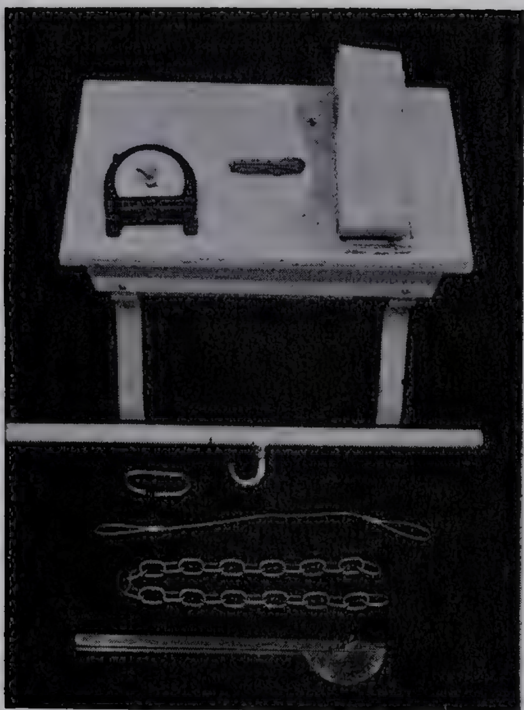


ILLUSTRATION III LEG LIFT AND BACK LIFT TEST APPARATUS

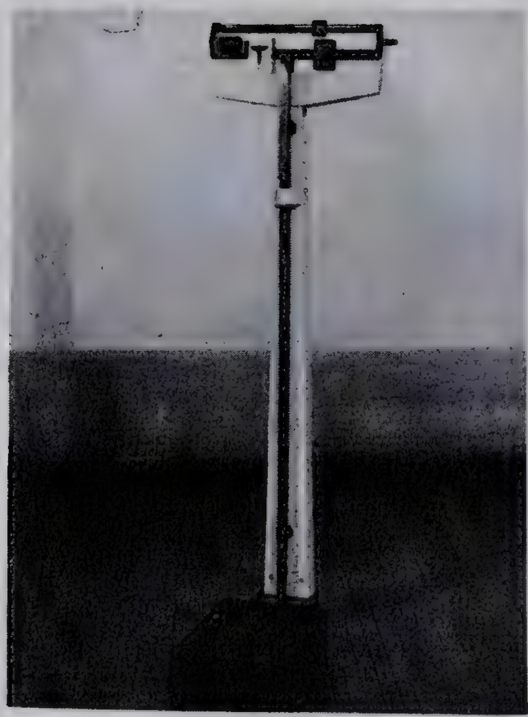


ILLUSTRATION V DETECTO SCALE

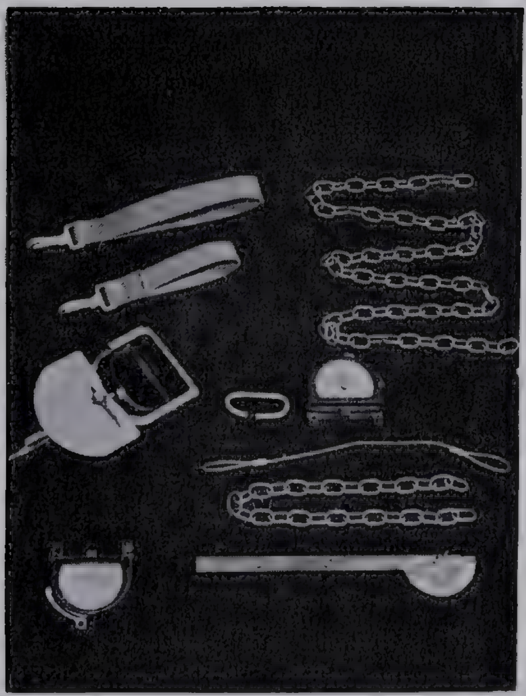


ILLUSTRATION IV SMEDLEY ADJUSTABLE GRID DYNAMOMETER, CABLE TENSIOMETERS, GONIOMETER, CABLE, AND ATTACHMENTS

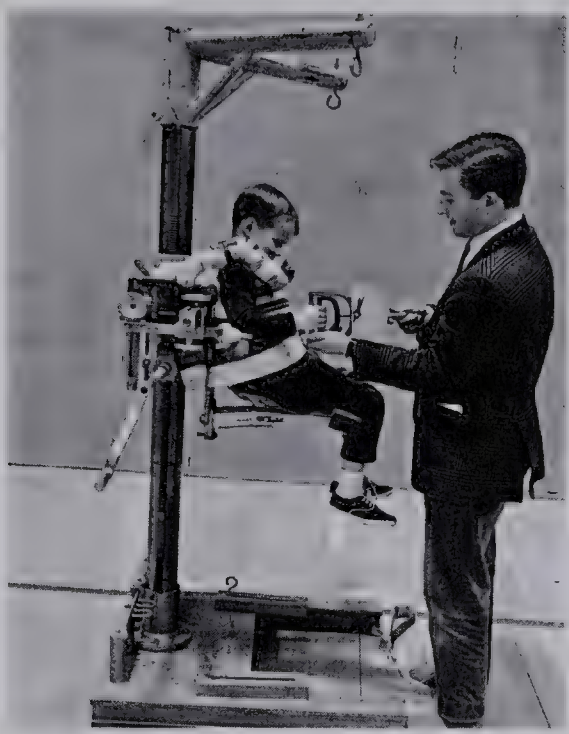
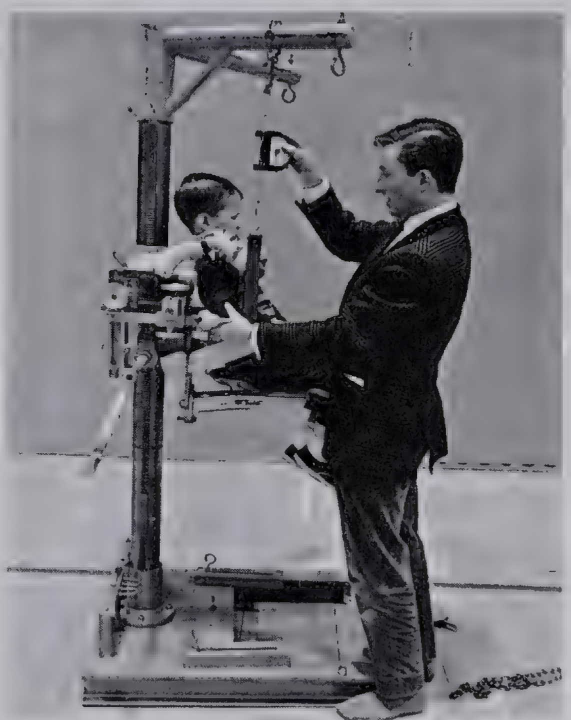


ILLUSTRATION VI TEST
OF RIGHT GRIP STRENGTH

ILLUSTRATION VIII TEST OF
RIGHT ELBOW EXTENSION STRENGTH



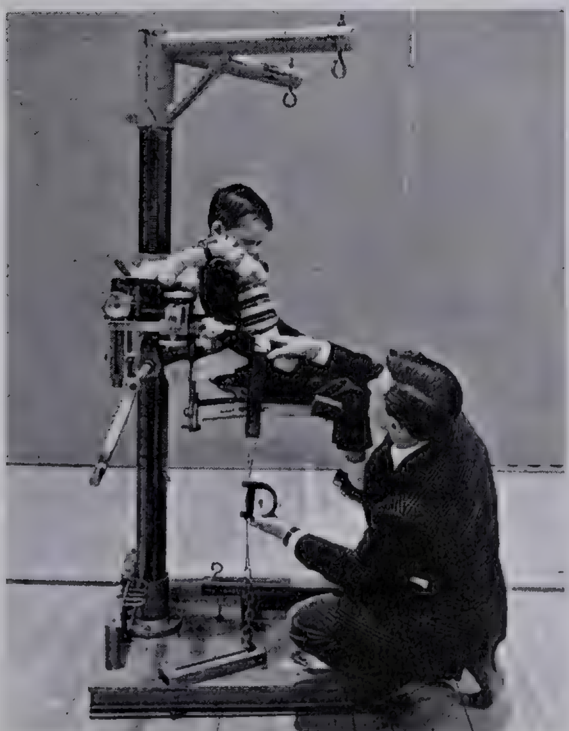


ILLUSTRATION VII TEST OF
RIGHT ELBOW FLEXION STRENGTH

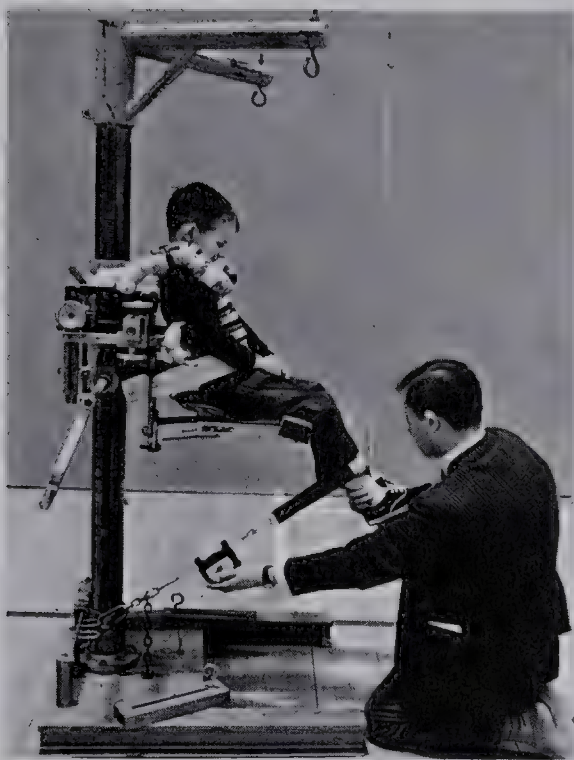


ILLUSTRATION IX TEST OF
RIGHT KNEE EXTENSION STRENGTH

ILLUSTRATION XI TEST
OF BACK LIFT STRENGTH

ILLUSTRATION X TEST
OF LEG LIFT STRENGTH

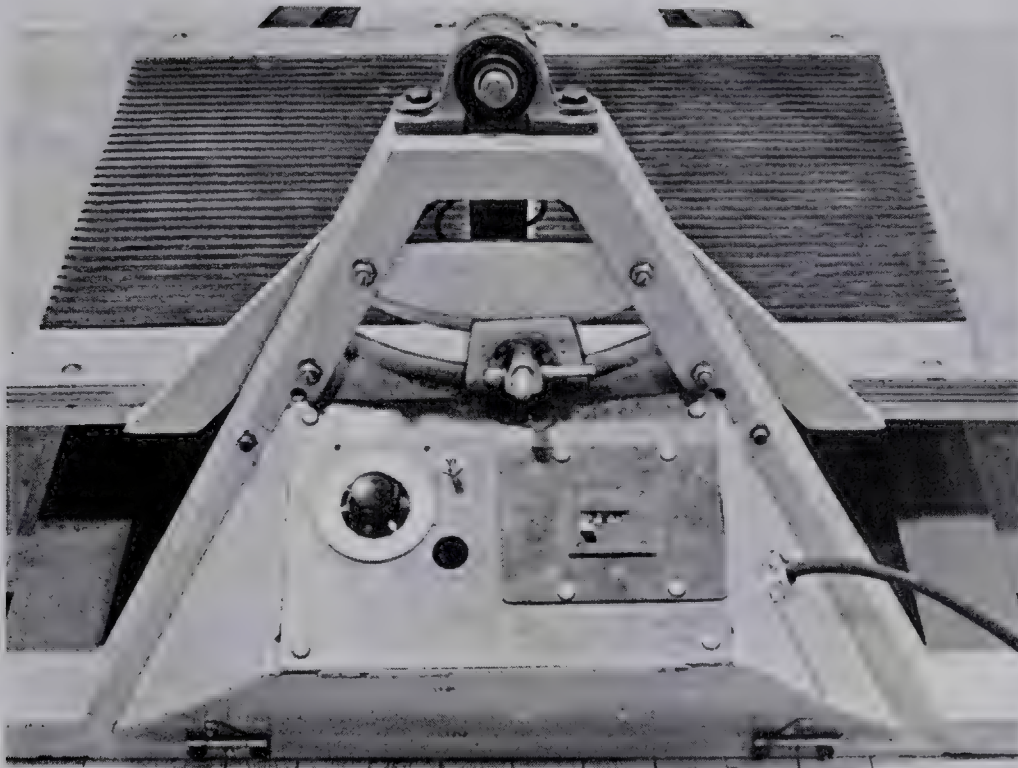


ILLUSTRATION XII
STABILOMETER - FRONT VIEW

ILLUSTRATION XIII
STABILOMETER TEST

Experimental Design

Arrangements were made with the principal and staff of the two schools for suitable testing areas. All items (excluding the 50 and 300 yard runs) were administered in a gymnasium, playroom or extra classroom. The 50 and 300 yard runs were carried out on a level, grassed area of the playground.

Testing Procedure

One test administrator supervised the movement of the subjects from their classrooms to the test area as was required. When the subjects entered the gymnasium, they were asked to remove their shoes and socks and then report in smaller groups to the pairs of administrators of the CAHPER Fitness-Performance test items. The administrators explained very carefully the requirements of the tests, then the subject performed the task. Upon completion of the CAHPER tests the subjects were taken to the health office where one administrator weighed, and measured the height of the subject, using a Detecto scale (Illustration V) and also determined the handedness of the subject. (Appendix B) The same administrator also collected from the school records the birthdate for each. A similar procedure was followed by the group of subjects who were tested on the strength machine, strength stool and stabilometer. The administrators explained the test to the subject, asked for his co-operation, and administered the respective test in the order and manner previously discussed. The second day procedures remained the same for

the strength machine, strength stool and stabilometer, while the three remaining CAHPER Fitness Performance items were administered in the following order: first, the flexed arm hang, performed in a doorway near the gymnasium; and then the 50 and 300 yard runs administered on the established area on the playground.

Length of the Study

The study began in September, 1966, and extended to the end of April, 1967. During September the initial testing covered a total of four successive days. Following the initial testing the subjects participated in their regular physical education programs. Four days final testing in April completed the test period.

Test Administration

The test items were administered by a team of eleven examiners, each of whom was provided with a test manual (Appendix A), and each of whom worked throughout the test period on a specific test item. The same procedures were followed for the September and April test periods.

Equipment Calibration

Tensiometers were calibrated prior to the testing periods by the Instrument Laboratory of Northwest Industries Limited of Edmonton. All equipment was carefully examined by the respective test administrators prior to the testing of all subjects. All measurements of length were made by standardized steel tapes. Detecto scales were carefully balanced prior to the weighing of all the subjects. All Hanhart stop watches

were calibrated by Freeman's Credit Jewellers, Edmonton, before the testing and then checked for standardization prior to testing.

Statistical Procedures

The statistical analysis for all items excluding the stabilometer included the following calculations:

1. Means, standard deviations and difference in means for each group for each test item in the initial and final test.

2. Within group analysis of variance for each group for each test item.

3. One-way analysis of covariance for each grade for each test item.

4. Two-way analysis of covariance for each item for the combined grades one and two in each school.

5. Reliability correlation coefficients for each item calculated for each class.

6. Zero order correlation for all parameters for each group during the September and April test periods.

The statistical analysis of the stabilometer results included the following calculations:

1. Determination of the September and April learning gain scores.

2. Means and standard deviations of the September and April learning gain scores.

3. t-tests between control and experimental groups in September.

4. Analysis of covariance.

5. Reliability correlation coefficients for each group.

6. Graphical representation of the average trial scores for each group.

CHAPTER IV

RESULTS AND DISCUSSION

The body of this chapter presents the results of the various statistical procedures applied to the test data obtained for the subjects in tabular form. A brief description of the parameter results summarized in each table is provided in the text prior to each table. The chapter includes the analysis of: mean scores, one way analysis of covariance for grade ones, one way analysis of covariance for grade twos, two way analysis of covariance for combined groups and the statistical analysis of the stabilometer.

Tables I through XVIII include grade one experimental and control groups, September and April test period means, standard deviations, difference in means and difference between difference scores for all items of the performance tests administered plus the same results for height (Table I) and weight (Table II), but excluding the stabilometer which will be discussed separately. The group demonstrating the greater difference between September and April scores has been noted. (e.g. C = control and E = experimental)

TABLE I

HEIGHT FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE ONE

School	September Mean (Inches)	Standard Deviation	April Mean (Inches)	Standard Deviation	Difference in Means (Inches)
Experimental	45.65	1.17	46.95	1.33	1.30
Control	46.72	1.21	48.08	1.41	1.36
Difference between difference scores C greater than E					.06

TABLE II

WEIGHT FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE ONE

School	September Mean (Pounds)	Standard Deviation	April Mean (Pounds)	Standard Deviation	Difference in Means (Pounds)
Experimental	46.28	3.65	50.68	3.31	4.40
Control	51.03	8.49	55.15	9.16	4.12
Difference between difference scores E greater than C					.28

The mean scores for the One Minute Speed Sit-ups (Table III) were calculated for each test period by recording the maximal number of complete sit-ups performed by each subject within the one minute time limit.

TABLE III

SIT UPS FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE ONE

School	September Mean	Standard Deviation	April Mean	Standard Deviation	Difference in Means
Experimental	8.75	6.33	14.55	7.76	5.80
Control	10.70	6.18	14.15	7.75	3.45
Difference between difference scores E greater than C 2.35					

The mean scores for the Standing Broadjump (Table IV) were calculated for the respective September and April test periods by recording the longer of two measured legal trials and recording the subject's score to the nearest inch.

TABLE IV

BROAD JUMP FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE ONE

School	September Mean (Inches)	Standard Deviation	April Mean (Inches)	Standard Deviation	Difference in Means (Inches)
Experimental	42.50	8.20	46.20	6.30	3.70
Control	43.25	6.44	43.50	6.75	.25
Difference between difference scores E greater than C 3.45					

The mean Shuttle Run (Table V) scores were calculated for each subject by taking the best of two trials recorded to the nearest tenth of a second to represent the respective September and April Shuttle Run score.

TABLE V

SHUTTLE RUN FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE ONE

School	September Mean (Seconds)	Standard Deviation	April Mean (Seconds)	Standard Deviation	Difference in Means (Seconds)
Experimental	15.75	1.17	14.97	0.85	.78
Control	15.12	1.22	15.71	1.07	-.59
Difference between difference scores E greater than C					1.37

The mean scores of each subject for the Flexed Arm Hang (Table VI) were calculated from one maximal trial for each subject during each of the September and April test periods. The results were recorded to the nearest second.

TABLE VI

FLEXED ARM HANG FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE ONE

School	September Mean (Seconds)	Standard Deviation	April Mean (Seconds)	Standard Deviation	Difference in Means (Seconds)
Experimental	12.35	12.95	13.70	8.40	1.35
Control	10.30	9.35	16.70	11.80	6.40
Difference between difference scores C greater than E					5.05

The mean scores for the 50 yard Run (Table (VII) were calculated for each subject during each test period by recording the elapsed time to the nearest tenth of a second.

TABLE VII

50 YARD RUN FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE ONE

School	September Mean (Seconds)	Standard Deviation	April Mean (Seconds)	Standard Deviation	Difference in Means (Seconds)
Experimental	11.78	0.90	10.34	0.81	1.44
Control	11.92	1.14	10.19	0.88	1.73
Difference between difference scores C greater than E					.29

The mean scores for the 300 yard Run (Table VIII) were calculated for each subject during each test period by recording the elapsed time to the nearest second.

TABLE VIII

300 YARD RUN FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE ONE

School	September Mean (Seconds)	Standard Deviation	April Mean (Seconds)	Standard Deviation	Difference in Means (Seconds)
Experimental	99.55	12.53	89.55	7.28	10.00
Control	100.95	13.00	90.65	6.31	10.35
Difference between difference scores C greater than E					.35

The means for the Right and Left Hand Grips (Tables IX and X) for both the experimental and control groups were calculated for each test period by determining the mean score of three maximal trials using the Smedley Adjustable Grip dynamometer for each subject during each test period.

TABLE IX

RIGHT HAND GRIP FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE ONE

School	September Mean (Pounds)	Standard Deviation	April Mean (Pounds)	Standard Deviation	Difference in Means (Pounds)
Experimental	16.65	4.60	17.20	5.08	.55
Control	17.55	5.15	18.55	2.74	1.00
Difference between difference scores C greater than E					.45

TABLE X

LEFT HAND GRIP FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE ONE

School	September Mean (Pounds)	Standard Deviation	April Mean (Pounds)	Standard Deviation	Difference in Means (Pounds)
Experimental	18.00	4.54	15.25	4.73	-2.75
Control	19.00	4.97	17.95	3.83	-1.05
Difference between difference scores E greater than C					1.70

The mean scores for: Right Elbow Flexion (Table XI), Left Elbow Flexion (Table XII), Right Elbow Extension (Table XIII), Left Elbow Extension (Table XIV), Right Knee Extension (Table XV), Left Knee Extension (Table XVI), Leg Lift (Table XVII) and Back Lift (Table XVIII); were calculated by recording the mean of three trials recorded by a Pacific cable tensiometer as the subjects score for the respective test period.

TABLE XI

RIGHT ELBOW FLEXION FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE ONE

School	September Mean (Pounds)	Standard Deviation	April Mean (Pounds)	Standard Deviation	Difference in Means (Pounds)
Experimental	20.50	4.29	24.60	6.19	4.10
Control	21.50	4.54	22.40	5.68	.90
Difference between difference scores E greater than C					3.20

TABLE XII

LEFT ELBOW FLEXION FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE ONE

School	September Mean (Pounds)	Standard Deviation	April Mean (Pounds)	Standard Deviation	Difference in Means (Pounds)
Experimental	18.95	4.87	22.35	5.45	3.40
Control	18.75	3.93	21.90	4.87	3.15
Difference between difference scores E greater than C					.25

TABLE XIII

RIGHT ELBOW EXTENSION FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE ONE

School	September Mean (Pounds	Standard Deviation	April Mean (Pounds)	Standard Deviation	Difference in Means (Pounds)
Experimental	21.65	3.83	21.35	5.32	-.30
Control	22.40	4.67	23.10	3.42	.70
Difference between difference scores C greater than E					1.00

TABLE XIV

LEFT ELBOW EXTENSION FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE ONE

School	September Mean (Pounds)	Standard Deviation	April Mean (Pounds)	Standard Deviation	Difference in Means (Pounds)
Experimental	20.25	3.52	21.80	5.47	1.55
Control	20.95	4.57	24.45	5.06	3.50
Difference between difference scores C greater than E					1.95

TABLE XV

RIGHT KNEE EXTENSION FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE ONE

School	September Mean (Pounds)	Standard Deviation	April Mean (Pounds)	Standard Deviation	Difference in Means (Pounds)
Experimental	37.75	8.21	39.70	9.73	1.95
Control	39.95	9.23	43.85	8.40	3.90
Difference between difference scores C greater than E					1.95

TABLE XVI

LEFT KNEE EXTENSION FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE ONE

School	September Mean (Pounds)	Standard Deviation	April Mean (Pounds)	Standard Deviation	Difference in Means (Pounds)
Experimental	34.90	7.74	39.95	9.84	5.05
Control	38.85	8.22	42.55	7.99	3.70
Difference between difference scores E greater than C					1.35

TABLE XVII

LEG LIFT FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE ONE

School	September Mean (Pounds)	Standard Deviation	April Mean (Pounds)	Standard Deviation	Difference in Means (Pounds)
Experimental	74.65	24.78	87.95	34.25	13.30
Control	73.65	24.02	104.00	26.63	30.35
Difference between difference scores C greater than E					17.05

TABLE XVIII

BACK LIFT FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE ONE

School	September Mean (Pounds)	Standard Deviation	April Mean (Pounds)	Standard Deviation	Difference in Means (Pounds)
Experimental	54.45	8.54	68.05	19.90	13.60
Control	58.80	13.52	73.90	20.29	15.10
Difference between difference scores C greater than E					1.50

Tables XIX through XXXVI include an outline of the grade two experimental and control groups September and April test period means, standard deviations, difference in means and difference between difference scores for all items of the performance tests administered plus the above results for height (Table XIX) and weight (Table XX) and excluding the stabilometer which will be discussed separately. The group demonstrating the greater difference between September and April scores has been noted.

TABLE XIX

HEIGHT FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE TWO

School	September Mean (Inches)	Standard Deviation	April Mean (Inches)	Standard Deviation	Difference in Means (Inches)
Experimental	48.38	2.31	49.25	2.57	.87
Control	48.30	1.79	49.68	1.94	1.38
Difference between difference scores C greater than E					.51

TABLE XX

WEIGHT FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE TWO

School	September Mean (Pounds)	Standard Deviation	April Mean (Pounds)	Standard Deviation	Difference in Means (Pounds)
Experimental	49.45	8.12	55.58	7.80	6.13
Control	54.48	6.11	59.65	7.58	5.17
Difference between difference scores E greater than C					.96

The mean scores for the One Minute Speed Sit-ups (Table XXI) were calculated for each test period by recording the maximal number of complete sit-ups performed by each subject within the one minute time limit.

TABLE XXI

SIT-UPS FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE TWO

School	September Mean	Standard Deviation	April Mean	Standard Deviation	Difference in Means
Experimental	13.40	8.09	19.05	6.84	5.65
Control	12.60	9.67	24.15	7.37	11.55
Difference between difference scores C greater than E					5.90

The mean scores for the Standing Broadjump (Table XXII) were calculated for the respective September and April test periods by recording the longer of two measured legal trials recorded to the nearest inch as the subject's score.

TABLE XXII

BROADJUMP FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE TWO

School	September Mean (Inches)	Standard Deviation	April Mean (Inches)	Standard Deviation	Difference in Means (Inches)
Experimental	46.15	5.82	50.95	4.56	4.20
Control	48.10	7.30	50.70	5.59	2.60
Difference between difference scores E greater than C					2.10

The mean Shuttle Run (Table XXIII) scores were calculated for each subject by taking the best of two trials recorded to the nearest tenth of a second to represent the respective September and April Shuttle Run score.

TABLE XXIII

SHUTTLE RUN FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE TWO

School	September Mean (Seconds)	Standard Deviation	April Mean (Seconds)	Standard Deviation	Difference in Means (Seconds)
Experimental	15.07	0.96	14.45	1.06	.62
Control	14.85	1.29	14.71	1.24	.14
Difference between difference scores E greater than C					.48

The mean scores of each subject for the Flexed Arm Hang (Table XXIV) were calculated from one maximal trial for each subject during each of the September and April test periods. The results were recorded to the nearest second.

TABLE XXIV

FLEXED ARM HANG FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE TWO

School	September Mean (Seconds)	Standard Deviation	April Mean (Seconds)	Standard Deviation	Difference in Means (Seconds)
Experimental	13.30	10.85	16.00	10.39	2.70
Control	12.95	7.19	20.45	13.67	7.50
Difference between difference scores C greater than E					4.80

The mean scores for the 50 Yard Run (Table XXV) were calculated for each subject during each test period by recording the elapsed time to the nearest tenth of a second.

TABLE XXV

50 YARD RUN FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE TWO

School	September Mean (Seconds)	Standard Deviation	April Mean (Seconds)	Standard Deviation	Difference in Means (Seconds)
Experimental	11.05	0.86	10.28	0.95	0.77
Control	10.63	0.76	9.43	1.01	1.20
				C > E	.43 Dif?

The mean scores for the 300 Yard Run (Table XXVI) were calculated for each subject during each test period by recording the elapsed time to the nearest second.

TABLE XXVI

300 YARD RUN FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE TWO

School	September Mean (Seconds)	Standard Deviation	April Mean (Seconds)	Standard Deviation	Difference in Means (Seconds)
Experimental	95.85	11.69	88.25	6.20	7.60
Control	90.50	10.70	82.60	7.34	7.90
Difference between difference scores C greater than E					.30

The means for the Right and Left Hand Grips (Tables XXVII and XXVIII) for both the experimental and control groups were calculated for each test period by determining the mean score of three maximal trials using the Smedley Adjustable Grip Dynamometer for each subject during each test period.

TABLE XXVII

RIGHT HAND GRIP FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE TWO

School	September Mean (Pounds)	Standard Deviation	April Mean (Pounds)	Standard Deviation	Difference in Means (Pounds)
Experimental	20.45	5.19	20.55	3.89	.10
Control	21.15	5.36	23.20	4.38	2.05
Difference between difference scores C greater than E					1.95

TABLE XXVIII

LEFT HAND GRIP FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE TWO

School	September Mean (Pounds)	Standard Deviation	April Mean (Pounds)	Standard Deviation	Difference in Means (Pounds)
Experimental	21.25	5.51	19.55	3.43	-1.75
Control	23.50	5.10	23.70	3.83	.20
Difference between difference scores C greater than E					1.95

The mean scores for: Right Elbow Flexion (Table XXIX), Left Elbow Flexion (Table XXX), Right Elbow Extension (Table XXXI), Left Elbow Extension (Table XXXII), Right Knee Extension (Table XXXIII), Left Knee Extension (Table XXXIV), Leg Lift (Table XXXV) and Back Lift (Table XXXVI); were calculated by recording the mean of three trials recorded by a Pacific cable tensiometer as the subjects score for the respective test period.

TABLE XXIX

RIGHT ELBOW FLEXION FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE TWO

School	September Mean (Pounds)	Standard Deviation	April Mean (Pounds)	Standard Deviation	Difference in Means (Pounds)
Experimental	22.90	5.83	22.25	4.99	-.65
Control	25.15	5.52	29.55	6.74	4.40
Difference between difference scores C greater than E					5.05

TABLE XXX

LEFT ELBOW FLEXION FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE TWO

School	September Mean (Pounds)	Standard Deviation	April Mean (Pounds)	Standard Deviation	Difference in Means (Pounds)
Experimental	21.20	5.43	20.70	5.54	-.50
Control	22.30	5.67	27.35	4.42	5.05
Difference between difference scores C greater than E					5.55

TABLE XXXI

RIGHT ELBOW EXTENSION FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE TWO

School	September Mean (Pounds)	Standard Deviation	April Mean (Pounds)	Standard Deviation	Difference in Means (Pounds)
Experimental	21.05	4.76	20.70	3.71	-.35
Control	26.45	6.35	29.10	5.05	2.65
Difference between difference scores C greater than E					3.00

TABLE XXXII

LEFT ELBOW EXTENSION FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE TWO

School	September Mean (Pounds)	Standard Deviation	April Mean (Pounds)	Standard Deviation	Difference in Means (Pounds)
Experimental	20.70	5.16	23.20	5.10	2.50
Control	25.90	5.60	31.10	6.42	5.20
Difference between difference scores C greater than E					2.70

TABLE XXXIII

RIGHT KNEE EXTENSION FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE TWO

School	September Mean (Pounds)	Standard Deviation	April Mean (Pounds)	Standard Deviation	Difference in Means (Pounds)
Experimental	38.95	8.49	43.80	8.38	4.85
Control	46.35	11.34	52.20	10.26	5.85
Difference between difference scores C greater than E					1.00

TABLE XXXIV

LEFT KNEE EXTENSION FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE TWO

School	September Mean (Pounds)	Standard Deviation	April Mean (Pounds)	Standard Deviation	Difference in Means (Pounds)
Experimental	38.95	10.00	44.25	10.02	5.30
Control	46.25	11.54	52.55	10.87	6.30
Difference between difference scores C greater than E					1.00

TABLE XXXV

LEG LIFT FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE TWO

School	September Mean (Pounds)	Standard Deviation	April Mean (Pounds)	Standard Deviation	Difference in Means (Pounds)
Experimental	81.40	23.04	112.55	36.94	31.15
Control	104.90	23.41	113.00	28.14	8.10
Difference between difference scores E greater than C					23.05

TABLE XXXVI

BACK LIFT FOR EXPERIMENTAL AND CONTROL GROUPS OF GRADE TWO

School	September Mean (Pounds)	Standard Deviation	April Mean (Pounds)	Standard Deviation	Difference in Means (Pounds)
Experimental	65.35	17.70	75.75	23.22	10.40
Control	64.90	19.70	85.10	21.77	20.20
Difference between difference scores C greater than E					9.80

One Way Analysis of Covariance for Grade Ones

Tables XXXVII through LIV inclusive, outline the tabular representation of the grade one results of the One Way Analysis of Covariance (AC-1000) as discussed by B.J. Winer (90:590) and calculated by the IBM 7040 computer.

The analysis of covariance was calculated using the September mean scores as the covariate and the April mean score as the criterion.

The level of significance demanded to show a significant difference in means was chosen to be the 0.05 level of probability. A calculated adjusted F score equal to or greater than 4.09 was required to demonstrate the 0.05 level of probability with an "n" of 39 while an adjusted F score equal to or greater than 4.10 was required to show significance with an "n" of 38. (36:410)

Table XXXVII illustrates the tabular results of the one way analysis of covariance calculated for the parameter height demonstrating no significant difference between the experimental and control groups.

TABLE XXXVII

1 - WAY ANALYSIS OF COVARIANCE - GRADE ONE HEIGHT

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	65.38			
Group	1	11.56	11.56	8.17	0.007
Within	38	53.81	1.42		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	78.75			
Group	1	12.63	12.63	7.26	0.01
Within	38	66.13	1.74		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	0.04	0.19	0.67
Within	37	0.22		
r^2	0.88			

The one way analysis of covariance (Table XXXVIII) calculated for the experimental and control groups on the parameter weight showed no significant difference between the groups.

TABLE XXXVIII

1 - WAY ANALYSIS OF COVARIANCE - GRADE ONE WEIGHT

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	1849.13			
Group	1	225.63	225.63	5.28	0.03
Within	38	1623.50	42.72		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	2003.00			
Group	1	200.25	200.25	4.22	0.05
Within	38	1802.75	47.44		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	0.003	0.0003	1.00
Within	37			
r^2	0.79			

No significant difference was shown between the experimental and control groups of grade ones for the number of maximal number of sit-ups completed within the one minute time limit as demonstrated by the calculations in Table XXXIX.

TABLE XXXIX

1 - WAY ANALYSIS OF COVARIANCE - GRADE ONE - SIT-UPS

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	1525.98			
Group	1	38.03	38.03	0.97	0.33
Within	38	1487.95	39.16		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	2285.10			
Group	1	1.60	1.60	0.027	0.87
Within	38	2283.50	60.09		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	36.13	0.97	0.33
Within	37	37.12		
r^2	0.40			

Table XL summarizes the results of the grade one standing broad-jump which showed significances at the 0.03 level of significance with a calculated adjusted F of 5.19 and an "n" of 38. The experimental group demonstrated the greater difference in mean scores over the test period.

TABLE XL

1 - WAY ANALYSIS OF COVARIANCE - GRADE ONE BROADJUMP

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	2072.38	5.63		
Group	1	5.63	5.63	0.10	0.75
Within	38	2063.75	54.39		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	1693.13			
Group	1	72.88	72.88	1.71	0.20
Within	38	1620.25	42.64		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	101.70	5.19	0.03
Within	37	19.59		
r^2	0.55			

Table XLI which summarizes the results of the one way analysis of covariance for the parameter the shuttle run demonstrates a significant difference between the scores of the two groups of 0.0001 which favours the experimental group.

TABLE XLI

1 - WAY ANALYSIS OF COVARIANCE - GRADE ONE SHUTTLE RUN

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	58.21			
Group	1	3.90	3.90	2.72	0.11
Within	38	54.39	1.43		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	40.79			
Group	1	5.47	5.47	5.89	0.02
Within	38	35.31	0.93		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	10.77	20.20	0.0001
Within	37	0.53		
r^2	0.44			

Grade one results of the flexed arm hang calculated by the computer program demonstrates no significant difference between the mean scores of the experimental and control groups.

TABLE XLII

1 - WAY ANALYSIS OF COVARIANCE - GRADE ONE FLEXED ARM HANG

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	4890.78			
Group	1	42.02	42.02	0.33	0.57
Within	38	4848.75	127.60		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	4074.40			
Group	1	90.00	90.00	0.86	0.36
Within	38	3984.41	104.85		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	167.80	2.43	0.13
Within	37	68.99		
r^2	0.36			

Table XLIII which summarizes the results of a test of one way analysis of covariance on the grade one scores for the 50 yard run shows no significance.

TABLE XLIII

1 - WAY ANALYSIS OF COVARIANCE - GRADE ONE 50 YARD RUN

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	40.09			
Group	1	0.18	0.18	0.18	0.68
Within	38	39.90	1.05		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	27.41			
Group	1	0.21	0.21	0.30	0.59
Within	38	27.20	0.72		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	0.53	1.71	0.20
Within	37	0.31		
r^2	0.58			

The results of the 300 yard run scores for the grade ones as summarized in Table XLIV shows no significance between the means of the experimental and control groups.

TABLE XLIV

1 - WAY ANALYSIS OF COVARIANCE - GRADE ONE 300 YARD RUN

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	6215.50			
Group	1	19.50	19.50	0.12	0.23
Within	38	6196.00	163.05		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	1775.63			
Group	1	12.06	12.06	0.26	0.61
Within	38	1763.56	46.41		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	4.78	0.14	0.71
Within	37	33.44		
r^2	0.30			

Table XLV and Table XLVI summarize the one way analysis of covariance for the grade one right hand and left hand grip strength tests. The results show no significant difference between the mean scores of the experimental and control groups.

TABLE XLV

1 - WAY ANALYSIS OF COVARIANCE - GRADE ONE RIGHT HAND GRIP

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	913.60			
Group	1	8.10	8.10	0.34	0.56
Within	38	905.50	23.83		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	652.38			
Group	1	18.22	18.22	1.09	0.30
Within	38	634.16	16.69		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	9.75	0 0.74	0.40
Within	37	13.26		
r^2	0.23			

TABLE XLVI

1 - WAY ANALYSIS OF COVARIANCE - GRADE ONE LEFT HAND GRIP

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	872.00			
Group	1	10.00	10.00	0.44	0.51
Within	38	862.00	22.68		

B. WITHIN VARIABLE ANALYSIS OF VARIABLE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	777.60			
Group	1	72.90	72.90	3.93	0.06
Within	38	704.70	18.55		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	52.12	3.42	0.07
Within	37	15.23		
r^2	0.20			

Tables XLVII and XLVIII which summarize the results of the one way analysis of covariance for right elbow and left elbow flexion of the grade one experimental and control groups did not demonstrate significant differences as prescribed by the conditions of probability required to meet the 0.05 level of probability. Probability for right elbow flexion was found to be 0.053 and for left elbow flexion a probability of 0.81.

TABLE XLVII

1 - WAY ANALYSIS OF COVARIANCE - GRADE ONE RIGHT ELBOW FLEXION

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	750.00			
Group	1	10.00	10.00	0.51	0.48
Within	38	740.00	19.47		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	1390.00			
Group	1	48.40	48.40	1.37	0.25
Within	38	1341.60	35.31		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	90.33	3.99	0.053
Within	37	22.63		
r^2	0.38			

TABLE XLVIII

1 - WAY ANALYSIS OF COVARIANCE - GRADE ONE LEFT ELBOW FLEXION

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	745.10			
Group	1	.40	.40	0.02	0.89
Within	38	744.70	19.60		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	1016.38			
Group	1	2.02	2.02	0.08	0.79
Within	38	1014.35	26.69		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	0.78	0.06	0.81
Within	37	12.83		
r^2	0.53			

The summarized results of the one way analysis of covariance applied to the results of the tests to determine right elbow and left elbow extension found no significant difference in the mean scores of the experimental and control groups.

TABLE XLIX

1 - WAY ANALYSIS OF COVARIANCE - GRADE ONE RIGHT ELBOW EXTENSION

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	698.98			
Group	1	5.63	5.63	0.31	0.58
Within	38	693.35	18.25		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	790.98			
Group	1	30.63	30.63	1.53	0.22
Within	38	760.35	20.01		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	17.74	1.19	0.28
Within	37	14.87		
r^2	0.28			

TABLE L

1 - WAY ANALYSIS OF COVARIANCE - GRADE ONE LEFT ELBOW EXTENSION

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	637.60			
Group	1	4.90	4.90	0.29	0.59
Within	38	632.70	16.65		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	1126.38			
Group	1	70.22	70.22	2.53	0.12
Within	38	1056.16	27.79		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	53.30	2.16	0.15
Within	37	24.69		
r^2	0.14			

Tables LI and LII show no significant difference between the mean scores of the experimental and control groups for either the right or left knee extension strength results.

TABLE LI

1 - WAY ANALYSIS OF COVARIANCE - GRADE ONE RIGHT KNEE EXTENSION

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	2947.10			
Group	1	48.40	48.40	0.63	0.43
Within	38	2898.70	76.28		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	3311.00			
Group	1	172.19	172.19	2.08	0.16
Within	38	3138.81	82.60		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	88.25	1.40	0.25
Within	37	63.28		
r^2	0.25			

TABLE LII

1 - WAY ANALYSIS OF COVARIANCE - GRADE ONE LEFT KNEE EXTENSION

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	2576.38			
Group	1	156.02	156.02	2.45	0.13
Within	38	2420.35	63.69		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	3121.50			
Group	1	67.56	67.56	0.84	0.37
Within	38	3053.94	80.37		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	0.51	.01	0.93
Within	37	59.20		
r^2	0.28			

The grade one one way analysis of covariance (Table LIII) for leg lift showed no significant difference between the mean scores of the experimental and control group.

TABLE LIII

1 - WAY ANALYSIS OF COVARIANCE - GRADE ONE LEG LIFT

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	22633.13			
Group	1	10.00	10.00	0.02	0.90
Within	38	22623.13	595.35		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	38337.00			
Group	1	2576.00	2576.00	2.74	0.11
Within	38	35761.00	941.08		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	2610.51	2.72	0.11
Within	37	959.02		
r^2	0.78			

Table LIV summarizes the results of the one way analysis of covariance for the back lift item in the test battery and shows no significant difference between the two groups.

TABLE LIV

1 - WAY ANALYSIS OF COVARIANCE - GRADE ONE BACK LIFT

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	5047.38			
Group	1	189.13	189.13	1.48	0.23
Within	38	4858.25	127.85		

B. WITHIN VARIABLE ANALYSIS OF VARIABLE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	15693.00			
Group	1	342.19	342.19	0.85	0.36
Within	38	15350.81	403.97		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	18.89	0.07	0.80
Within	37	277.68		
r^2	0.33			

<u>One Way Analysis of Covariance for Grade Twos</u>

Tables LV through LXXII inclusive outline the tabular representation of the grade two results of the One Way Analysis of Covariance (AC-1000) as discussed by B.J. Winer (90:590) and calculated by the IBM 7040 computer.

The analysis of covariance was calculated using the September mean scores as the covariate and the April mean score as the criterion.

The level of significance demanded to show a significant difference in means was chosen to be the 0.05 level of probability. A calculated F

score equal to or greater than 4.09 was required to demonstrate the 0.05 level of probability with an "n" of 39 while an adjusted F score equal to or greater than 4.10 was required to show significance with an "n" of 38. (36:410)

Table LV outlines the tabular result of the one way analysis of covariance for the parameter height of the grade two groups involved in the study. A significant difference at the 0.006 level of probability was found which favored the control group.

TABLE LV

1 - WAY ANALYSIS OF COVARIANCE - GRADE TWO HEIGHT

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	162.75			
Group	1	0.06	0.06	0.02	0.91
Within	38	162.69	4.28		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	199.25			
Group	1	1.81	1.81	0.35	0.56
Within	38	197.44	5.20		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	2.55	8.53	0.006
Within	37	0.30		
r^2	0.94			

The one way analysis of covariance for the item weight summarized in table LVI found no significant difference between the weight of the subjects.

TABLE LVI

1 - WAY ANALYSIS OF COVARIANCE - GRADE TWO WEIGHT

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	2209.25			
Group	1	252.50	252.50	4.90	0.03
Within	38	1956.75	51.49		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	2414.75			
Group	1	166.00	166.00	2.81	0.10
Within	38	2248.75	59.18		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	9.57	1.57	0.22
Within	37	6.11		
r^2	0.90			

Table LVII, grade two sit ups, illustrates a significant difference favoring the control group of grade twos where the probability was found to be 0.001.

TABLE LVII

1 - WAY ANALYSIS OF COVARIANCE - GRADE TWO SIT UPS

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	3026.00			
Group	1	6.40	6.40	0.08	0.78
Within	38	3019.60	79.46		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	2181.60			
Group	1	260.10	260.10	5.14	0.03
Within	38	1921.50	50.57		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	308.44	12.34	0.001
Within	37	25.00		
r^2	0.52			

No significant difference was found between the control and experimental groups of grade twos by the one way analysis of covariance reported in Table LVIII.

TABLE LVIII

1 - WAY ANALYSIS OF COVARIANCE - GRADE TWO BROAD JUMP

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	1694.38			
Group	1	38.00	38.00	0.87	0.36
Within	38	1656.38	43.59		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	989.81			
Group	1	.63	.63	0.02	0.88
Within	38	989.19	26.03		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	14.43	0.91	0.35
Within	37	15.82		
r^2	0.41			

Table LIX, grade two shuttle run, reports no significant difference between the two groups tested.

TABLE LIX

1 - WAY ANALYSIS OF COVARIANCE - GRADE TWO SHUTTLE RUN

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	49.95			
Group	1	0.50	0.50	0.39	0.54
Within	38	49.44	1.30		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	51.42			
Group	1	0.72	0.72	0.54	0.47
Within	38	50.70	1.33		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	1.95	3.44	0.07
Within	37	0.56		
r^2	0.59			

The one way analysis of covariance calculated for the flexed arm hang of the grade twos and reported in Table LX shows no significant difference between the two groups.

TABLE LX

1 - WAY ANALYSIS OF COVARIANCE - GRADE TWO FLEXED ARM HANG

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	3222.38			
Group	1	1.22	1.22	0.01	0.91
Within	38	3221.15	84.77		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	5800.98			
Group	1	198.02	198.02	1.34	0.25
Within	38	5602.95	147.45		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	221.17	2.09	0.16
Within	37	105.67		
r^2	0.30			

A significant difference at the 0.04 level of probability was found by the one way analysis of covariance calculated on the results of the 50 yard run for the grade twos as the control group demonstrated the better mean time.

TABLE LXI

1 - WAY ANALYSIS OF COVARIANCE - GRADE TWO 50 YARD RUN

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	26.97			
Group	1	1.77	1.77	2.67	0.11
Within	38	25.20	0.66		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	43.62			
Group	1	7.14	7.14	7.44	0.01
Within	38	36.48	0.96		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	2.23	4.50	0.04
Within	37	0.50		
r^2	0.50			

The 0.04 level of probability found for the 50 yard run in Table LXI favoring the control group was found to also exist with reference to the 300 yard run which is reported in Table LXII.

TABLE LXII

1 - WAY ANALYSIS OF COVARIANCE - GRADE TWO 300 YARD RUN

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	5057.81			
Group	1	286.25	286.25	2.30	0.14
Within	38	4771.56	125.57		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	2071.81			
Group	1	319.25	319.25	6.92	0.01
Within	38	1752.	46.12		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	186.21	4.56	0.04
Within	37	40.80		
r^2	0.14			

Tables LXIII and LXIV report the results of the one way analysis of covariance for the grade two right hand and left hand grips respectively. A significant difference was found between the control group and experimental group in both cases. The level of probability was 0.03 for the right hand grip and 0.001 for the left hand grip favoring the control group in both instances.

TABLE LXIII

1 - WAY ANALYSIS OF COVARIANCE - GRADE TWO RIGHT HAND GRIP

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	1062.40			
Group	1	4.90	4.90	0.18	0.68
Within	38	1057.50	27.83		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	722.38			
Group	1	70.22	70.22	4.09	0.05
Within	38	652.16	17.16		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	51.73	5.37	0.03
Within	37	9.63		
r^2	0.45			

TABLE LXIV

1 - WAY ANALYSIS OF COVARIANCE - GRADE TWO LEFT HAND GRIP

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	1123.38			
Group	1	50.03	50.03	1.79	0.19
Within	38	1072.75	28.23		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	673.38			
Group	1	172.22	172.22	13.06	0.001
Within	38	501.16	13.19		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	92.68	12.50	0.001
Within	37	7.42		
r^2	0.45			

The tabular results of the one way analysis of covariance for the parameters right elbow flexion strength and left elbow flexion strength reported in Table LXV and Table LXVI demonstrates significance in both items. For right elbow flexion the probability was 0.0008 while for left elbow flexion the probability was 0.0002 both favoring the control group.

TABLE LXV

1 - WAY ANALYSIS OF COVARIANCE - GRADE TWO RIGHT ELBOW FLEXION

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	1276.98			
Group	1	50.63	50.63	1.57	0.22
Within	38	1226.35	32.27		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	1871.60			
Group	1	532.90	532.90	15.13	0.0004
Within	38	1338.70	35.23		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	361.70	13.24	0.0008
Within	37	27.33		
r^2	0.25			

TABLE LXVI

1 - WAY ANALYSIS OF COVARIANCE - GRADE TWO LEFT ELBOW FLEXION

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	1181.50			
Group	1	12.09	12.09	0.39	0.54
Within	38	1169.41	30.77		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	1396.98			
Group	1	442.22	442.22	17.60	0.0002
Within	38	954.75	25.13		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	402.75	16.86	0.0002
Within	37	23.89		
r^2	0.74			

Table LXVII, grade two right elbow extension, reports a significant difference of 0.00003 favoring the control group while Table LXVIII, grade two left elbow extension, reports a significant difference of 0.005 also favoring the control group.

TABLE LXVII

1 - WAY ANALYSIS OF COVARIANCE - GRADE TWO RIGHT ELBOW EXTENSION

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	1487.50			
Group	1	291.59	291.59	9.27	0.004
Within	38	1195.91	31.47		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	1451.60			
Group	1	705.60	705.60	35.94	0.00000
Within	38	746.00	19.63		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	412.27	22.33	0.00003
Within	37	18.46		
r^2	0.84			

TABLE LXVIII

1 - WAY ANALYSIS OF COVARIANCE - GRADE TWO LEFT ELBOW EXTENSION

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	1376.78			
Group	1	275.62	275.62	9.51	0.004
Within	38	1101.16	28.98		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	1899.10			
Group	1	624.10	624.10	18.60	0.0001
Within	38	1275.00	33.55		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	274.91	9.17	0.005
Within	37	29.98		
r^2	0.13			

No significant difference between the two groups of grade twos on the parameters of right knee extension (Table LXIX) and left knee extension (Table LXX) was found using the one way analysis of covariance.

TABLE LXIX

1 - WAY ANALYSIS OF COVARIANCE - GRADE TWO RIGHT KNEE EXTENSION

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	4361.13			
Group	1	547.56	547.56	5.46	0.02
Within	38	3813.56	100.36		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	4040.00			
Group	1	705.56	705.56	8.04	0.007
Within	38	3334.44	87.75		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	224.02	3.24	0.08
Within	37	69.14		
r^2	0.23			

TABLE LXX

1 - WAY ANALYSIS OF COVARIANCE - GRADE TWO LEFT KNEE EXTENSION

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	4961.63			
Group	1	532.88	532.88	4.57	0.04
Within	38	4428.75	116.55		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	4837.63			
Group	1	688.88	688.88	6.31	0.02
Within	38	4148.75	109.18		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	139.83	2.00	0.17
Within	37	69.80		
r^2	0.38			

Table LXXI reporting the one way analysis of covariance calculated for the grade two leg lift shows no significant difference between the control group and experimental group.

TABLE LXXI

1 - WAY ANALYSIS OF COVARIANCE - GRADE TWO LEG LIFT

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	30943.13			
Group	1	5522.50	5522.50	8.26	0.007
Within	38	25420.63	668.96		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	40983.00			
Group	1	2.00	2.00	0.001	0.97
Within	38	40981.00	1078.45		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	1738.15	2.10	0.16
Within	37	827.83		
r^2	0.25			

The back lift results are outlined in Table LXXII show no significant difference between the experimental and control groups.

TABLE LXXII

1 - WAY ANALYSIS OF COVARIANCE - GRADE TWO BACK LIFT

A. WITHIN VARIABLE ANALYSIS OF VARIANCE - SEPTEMBER

Source	DF	SS	MS	F	Probability
Total	39	13330.38			
Group	1	2.00	2.00	0.006	0.94
Within	38	13328.38	350.75		

B. WITHIN VARIABLE ANALYSIS OF VARIANCE - APRIL

Source	DF	SS	MS	F	Probability
Total	39	20121.81			
Group	1	874.25	874.25	1.73	0.20
Within	38	19247.56	506.52		

C. ADJUSTED ANALYSIS OF VARIANCE - COVARIANCE

Source	DF	MS	Adjusted F	Probability
Group	1	916.80	2.13	0.15
Within	37	429.88		
r^2	0.17			

Two Way Analysis of Covariance for Combined Groups

Tables LXXIII through XC inclusive outline the tabular representations of the two way analysis of covariance for the combined groups calculated by the IBM 7040 computer programmed to express the output as outlined by B.J. Winer. (90:600)

The analysis of covariance was calculated using the mean scores of the combined grades one and two of the experimental school and the mean scores of combined grades one and two of the control school. The September scores were used as the covariate while the April scores were

the criterion. The total number of subjects was equal to eighty (forty subjects in the experimental group and forty subjects in the control group.)

Calculated F scores were compiled for the following sources of variation: school, grade and interaction. The level of significance demanded to show a significant difference in means was chosen to be the 0.05 level of probability.

Table LXXIII which summarizes the results of the analysis of covariance for the two groups (experimental and control) on the parameter height shows a significant difference in all three sources: a probability of 0.04 is found between schools (method), 0.02 between between grades (grade one compared to grade two) and 0.02 for interaction.

TABLE LXXIII

ANALYSIS OF COVARIANCE COMBINED GROUPS - HEIGHT

A. ANALYSIS OF VARIANCE ON CRITERION - APRIL

Source	SS	DF	MS	F	Probability
School	12.00	1	12.00	3.46	0.07
Grade	76.00	1	76.00	21.92	0.000
Interaction	2.50	1	2.50	0.72	0.40
Error	263.50	76	3.47		

B. ANALYSIS OF VARIANCE ON COVARIATE - SEPTEMBER

Source	SS	DF	MS	F	Probability
School	5.00	1	5.00	1.76	0.19
Grade	92.44	1	92.44	32.45	0.000
Interaction	6.56	1	6.56	2.30	0.13
Error	216.50	76	2.85		

C. ANALYSIS OF COVARIANCE

Source	SS	DF	MS	F	Probability
School	1.15	1	1.15	4.50	0.04
Grade	1.58	1	1.58	6.18	0.02
Interaction	1.37	1	1.37	5.36	0.02
Error	19.16	75	0.26		

The analysis of covariance for the parameter weight (Table LXXIV) shows a significant difference only between grades where the probability is 0.03.

TABLE LXXIV

ANALYSIS OF COVARIANCE COMBINED GROUPS - WEIGHT

A. ANALYSIS OF VARIANCE ON CRITERION - APRIL

Source	SS	DF	MS	F	Probability
School	365.63	1	365.63	6.86	0.01
Grade	441.88	1	441.88	8.29	0.005
Interaction	0.69	1	0.69	0.01	0.91
Error	4051.44	76	53.31		

B. ANALYSIS OF VARIANCE ON COVARIANCE - SEPTEMBER

Source	SS	DF	MS	F	Probability
School	477.75	1	477.75	10.14	0.002
Grade	219.44	1	219.44	4.66	0.03
Interaction	0.31	1	0.31	0.01	0.94

C. ANALYSIS OF COVARIANCE

Source	SS	DF	MS	F	Probability
School	4.66	1	4.66	0.58	0.45
Grade	39.41	1	39.41	4.89	0.03
Interaction	2.46	1	2.46	0.31	0.58
Error	604.42	75	8.06		

The parameter sit ups found no significant difference between the schools (method), but a highly significant difference between grades as the calculated F of 16.18 provided a probability of 0.000 while the probability for the source of interaction was 0.005.

TABLE LXXV

ANALYSIS OF COVARIANCE COMBINED GROUPS - SIT UPS

A. ANALYSIS OF VARIANCE ON CRITERION - APRIL

Source	SS	DF	MS	F	Probability
School	110.45	1	110.45	2.00	0.16
Grade	1051.25	1	1051.25	19.00	0.000
Interaction	151.25	1	151.25	2.73	0.10
Error	4205.00	76	4205.00		

B. ANALYSIS OF VARIANCE ON CRITERION - SEPTEMBER

Source	SS	DF	MS	F	Probability
School	6.61	1	6.61	0.11	0.74
Grade	214.51	1	214.51	3.62	0.06
Interaction	37.81	1	37.81	0.64	0.43
Error	4507.55	76	4507.55		

C. ANALYSIS OF COVARIANCE

Source	SS	DF	MS	F	Probability
School	78.32	1	78.32	2.51	0.12
Grade	505.19	1	505.19	16.18	0.000
Interaction	261.94	1	261.94	8.39	0.005
Error	2341.23	75			

Table LXXVI which outlines the results of the analysis of covariance for broadjump shows a significant difference between: school favoring the experimental (method) group, probability of 0.02; grade, probability of 0.001; and no significant difference seen in the interaction variable.

TABLE LXXVI

ANALYSIS OF COVARIANCE COMBINED GROUPS - BROADJUMP

A. ANALYSIS OF VARIANCE ON CRITERION - APRIL

Source	SS	DF	MS	F	Probability
School	43.56	1	43.56	1.27	0.26
Grade	714.06	1	714.06	20.80	0.000
Interaction	29.94	1	29.94	0.87	0.35
Error	2609.38	76	34.33		

B. ANALYSIS OF VARIANCE ON COVARIATE - SEPTEMBER

Source	SS	DF	MS	F	Probability
School	36.44	1	36.44	0.74	0.39
Grade	361.25	1	361.25	7.37	0.008
Interaction	7.19	1	7.19	0.15	0.70
Error	3723.13	76	48.99		

C. ANALYSIS OF COVARIANCE

Source	SS	DF	MS	F	Probability
School	101.70	1	101.70	5.71	0.02
Grade	221.92	1	221.92	12.47	0.001
Interaction	15.11	1	15.11	6.85	0.36
Error	1334.97	75	17.80		

Table LXXVII summarizing the results of the analysis of covariance shows a significant difference in all three sources of variation. The difference between schools proved to be highly significant in favor of the experimental group as the calculated F of 20.95 provided a 0.000 probability. A significant difference between grades was shown by the probability of 0.01 while the probability for the interaction sources of variation was found to be 0.03.

TABLE LXXVII

ANALYSIS OF COVARIANCE COMBINED GROUPS - SHUTTLE RUN

A. ANALYSIS OF VARIANCE ON CRITERION - APRIL

Source	SS	DF	MS	F	Probability
School	3.11	1	5.11	4.52	0.04
Grade	11.26	1	11.26	9.95	0.002
Interaction	1.09	1	1.09	0.96	0.33
Error	85.95	76	1.13		

B. ANALYSIS OF VARIANCE ON COVARIATE - SEPTEMBER

Source	SS	DF	MS	F	Probability
School	3.62	1	3.62	2.65	0.11
Grade	4.52	1	4.52	3.31	0.07
Interaction	0.79	1	0.79	0.58	0.45
Error	103.75	76	1.37		

C. ANALYSIS OF COVARIANCE

Source	SS	DF	MS	F	Probability
School	11.79	1	11.79	20.95	0.000
Grade	3.74	1	3.74	6.65	0.01
Interaction	2.64	1	2.64	4.68	0.03
Error	42.21	75	0.56		

The results of the analysis of covariance calculated for the data collected on the test item, flexed arm hang, and found in Table LXXVIII find a significant difference only between schools where the probability is 0.04 and favors the control group.

TABLE LXXVIII

ANALYSIS OF COVARIANCE COMBINED GROUPS - FLEXED ARM HANG

A. ANALYSIS OF VARIANCE ON CRITERION - APRIL

Source	SS	DF	MS	F	Probability
School	277.52	1	277.52	2.20	0.14
Grade	183.02	1	183.02	1.45	0.23
Interaction	10.51	1	10.51	0.08	0.77
Error	9587.35	76	126.15		

B. ANALYSIS OF VARIANCE ON COVARIATE - SEPTEMBER

Source	SS	DF	MS	F	Probability
School	28.80	1	28.80	0.27	0.60
Grade	64.80	1	64.80	0.61	0.44
Interaction	14.45	1	14.45	0.14	0.71
Error	8069.90	76	106.18		

C. ANALYSIS OF COVARIANCE

Source	SS	DF	MS	F	Probability
School	397.15	1	397.15	4.56	0.04
Grade	72.87	1	72.87	0.84	0.36
Interaction	0.30	1	0.80	0.01	0.92
Error	6526.05	75	87.01		

Table LXXIX shows the results of the analysis of covariance calculated for the parameter the 50 yard run. A significant difference was found only in one source of variation, a probability of 0.008 was found for the source of variation schools or method. No significant difference was found for the sources of variation grade and interaction.

TABLE LXXIX

ANALYSIS OF COVARIANCE COMBINED GROUPS - 50 YARD RUN

A. ANALYSIS OF VARIANCE ON CRITERION - APRIL

Source	SS	DF	MS	F	Probability
School	4.90	1	4.90	5.85	0.02
Grade	3.36	1	3.36	4.01	0.05
Interaction	2.45	1	2.45	2.93	0.09
Error	63.64	76	0.84		

B. ANALYSIS OF VARIANCE ON COVARIATE - SEPTEMBER

Source	SS	DF	MS	F	Probability
School	0.41	1	0.41	0.47	0.49
Grade	20.30	1	20.30	23.73	0.000
Interaction	1.54	1	1.54	1.80	0.18
Error	65.01	76	0.86		

C. ANALYSIS OF COVARIANCE

Source	SS	DF	MS	F	Probability
School	3.07	1	3.07	7.55	0.008
Grade	1.45	1	1.45	3.56	0.06
Interaction	0.46	1	0.46	1.12	0.30
Error	30.55	75	0.41		

The analysis of covariance for the 300 yard run (Table LXXX) found no significant difference between the sources of variation school and interaction, but found a significant difference between the grade ones and twos of the test sample. The probability found was 0.05.

TABLE LXXX

ANALYSIS OF COVARIANCE COMBINED GROUPS - 300 YARD RUN

A. ANALYSIS OF VARIANCE ON CRITERION - APRIL

Source	SS	DF	MS	F	Probability
School	103.63	1	103.63	2.24	0.14
Grade	437.19	1	437.19	9.45	0.003
Interaction	227.75	1	227.75	4.92	0.03
Error	3516.06	76	46.26		

B. ANALYSIS OF VARIANCE ON COVARIATE - SEPTEMBER

Source	SS	DF	MS	F	Probability
School	77.81	1	77.81	0.54	0.47
Grade	1001.00	1	1001.00	6.94	0.01
Interaction	228.12	1	228.12	1.58	0.21
Error	10967.50	76	144.31		

C. ANALYSIS OF COVARIANCE

Source	SS	DF	MS	F	Probability
School	61.46	1	61.46	1.67	0.20
Grade	145.55	1	145.55	3.96	0.05
Interaction	120.90	1	120.90	3.29	0.07
Error	2758.54	75	36.78		

The analysis of covariance calculated in Table LXXXI for the right hand grip found a significant difference with a probability of 0.04 favoring the control group for the source of variation school and a probability of 0.006 for the source of variation grade while no significant difference was found in interaction.

TABLE LXXXI

ANALYSIS OF COVARIANCE COMBINED GROUPS - RIGHT HAND GRIP

A. ANALYSIS OF VARIANCE ON CRITERION - APRIL

Source	SS	DF	MS	F	Probability
School	80.00	1	80.00	4.73	0.03
Grade	320.00	1	320.00	18.91	0.000
Interaction	8.45	1	8.45	0.50	0.48
Error	1286.30	76	16.93		

B. ANALYSIS OF VARIANCE ON COVARIATE - SEPTEMBER

Source	SS	DF	MS	F	Probability
School	12.80	1	12.80	0.50	0.48
Grade	273.80	1	273.80	10.60	0.002
Interaction	0.20	1	0.20	0.01	0.93
Error	1963.00	76	25.83		

C. ANALYSIS OF COVARIANCE

Source	SS	DF	MS	F	Probability
School	52.48	1	52.48	4.60	0.04
Grade	90.15	1	90.15	7.90	0.006
Interaction	9.71	1	9.71	0.85	0.36
Error	855.31	75	11.40		

Table LXXXII summarizing the results of the analysis of covariance shows similar results for the left hand as compared with the results for the right hand in Table LXXXI. Sources of variation showing significant differences are school favoring the control group (probability 0.001) and grade (probability 0.000) while no significant interaction was noted.

TABLE LXXXII

ANALYSIS OF COVARIANCE COMBINED GROUPS - LEFT HAND GRIP

A. ANALYSIS OF VARIANCE ON CRITERION - APRIL

Source	SS	DF	MS	F	Probability
School	234.61	1	234.61	14.79	0.000
Grade	505.01	1	505.01	31.83	0.000
Interaction	10.51	1	10.51	0.66	0.42
Error	1205.85	76	15.87		

B. ANALYSIS OF VARIANCE ON COVARIATE - SEPTEMBER

Source	SS	DF	MS	F	Probability
School	52.81	1	52.81	2.07	0.154
Grade	300.31	1	300.31	11.80	0.001
Interaction	7.81	1	7.81	0.31	0.58
Error	1934.75	76	25.46		

C. ANALYSIS OF COVARIANCE

Source	SS	DF	MS	F	Probability
School	143.87	1	143.87	12.84	0.001
Grade	193.15	1	193.15	17.24	0.000
Interaction	4.09	1	4.09	0.37	0.55
Error	840.07	75	11.20		

Right elbow flexion results were summarized in Table LXXXIII. No significance was noted for the sources of variation school and grade, however, a highly significant interaction with an F of 14.97 and probability of 0.000 was reported.

TABLE LXXXIII

ANALYSIS OF COVARIANCE COMBINED GROUPS - RIGHT ELBOW FLEXION

A. ANALYSIS OF VARIANCE ON CRITERION - APRIL

Source	SS	DF	MS	F	Probability
School	130.05	1	130.05	3.69	0.06
Grade	115.20	1	115.20	3.27	0.08
Interaction	451.25	1	451.25	12.80	0.001
Error	2680.30	76	35.27		

B. ANALYSIS OF VARIANCE ON COVARIATE - SEPTEMBER

Source	SS	DF	MS	F	Probability
School	52.81	1	52.81	2.04	0.16
Grade	183.01	1	183.01	7.07	0.01
Interaction	7.81	1	7.81	0.30	0.58
Error	1966.35	76	25.87		

C. ANALYSIS OF COVARIANCE

Source	SS	DF	MS	F	Probability
School	45.08	1	45.08	1.79	0.19
Grade	4.30	1	4.30	0.17	0.68
Interaction	377.70	1	377.70	14.97	0.000
Error	1892.21	75	25.23		

A probability of 0.006 favoring the control group was noted in the analysis of covariance of left elbow flexion reported in Table LXXXIV. No significance was noted between grades, but a significant interaction with a probability of 0.002 was calculated.

TABLE LXXXIV

ANALYSIS OF COVARIANCE COMBINED GROUPS - LEFT ELBOW FLEXION

A. ANALYSIS OF VARIANCE ON CRITERION - APRIL

Source	SS	DF	MS	F	Probability
School	192.20	1	192.20	7.42	0.008
Grade	72.20	1	72.20	2.79	0.10
Interaction	252.05	1	252.05	9.73	0.003
Error	1969.10	76	25.91		

B. ANALYSIS OF VARIANCE ON COVARIATE - SEPTEMBER

Source	SS	DF	MS	F	Probability
School	4.05	1	4.05	0.16	0.69
Grade	168.20	1	168.20	6.68	0.01
Interaction	8.45	1	8.45	0.34	0.56
Error	1914.10	76	25.19		

C. ANALYSIS OF COVARIANCE

Source	SS	DF	MS	F	Probability
School	165.91	1	165.91	8.16	0.006
Grade	4.65	1	4.65	0.23	0.63
Interaction	208.64	1	208.64	10.26	0.002
Error	1525.03	75	20.33		

Table LXXXV, right elbow extension, reports significance in all three sources of variation. A probability of 0.000 favors the control group for the variable school (method). The probabilities for grade and interaction are 0.03 and 0.01 respectively.

TABLE LXXXV

ANALYSIS OF COVARIANCE COMBINED GROUPS - RIGHT ELBOW EXTENSION

A. ANALYSIS OF VARIANCE ON CRITERION - APRIL

Source	SS	DF	MS	F	Probability
School	515.11	1	515.11	25.99	0.000
Grade	143.11	1	143.11	7.22	0.009
Interaction	221.12	1	221.12	11.16	0.001
Error	1506.35	76	19.82		

B. ANALYSIS OF VARIANCE ON COVARIATE - SEPTEMBER

Source	SS	DF	MS	F	Probability
School	189.11	1	189.11	7.61	0.007
Grade	59.51	1	59.51	2.39	0.13
Interaction	108.11	1	108.11	4.35	0.04
Error	1889.25	76	24.86		

C. ANALYSIS OF COVARIANCE

Source	SS	DF	MS	F	Probability
School	291.93	1	291.93	17.12	0.000
Grade	83.56	1	83.56	4.90	0.03
Interaction	119.91	1	119.91	7.03	0.01
Error	1278.53	75	17.05		

The results of the analysis of covariance of the parameter left elbow extension reported in Table LXXXVI outline the following: a significant difference between schools with a probability of 0.001 favoring the control group, significant difference between grades 0.02 and no significant interaction.

TABLE LXXXVI

ANALYSIS OF COVARIANCE COMBINED GROUPS - LEFT ELBOW EXTENSION

A. ANALYSIS OF VARIANCE ON CRITERION - APRIL

Source	SS	DF	MS	F	Probability
School	556.61	1	556.51	18.14	0.000
Grade	324.01	1	324.01	10.56	0.002
Interaction	137.81	1	137.81	4.49	0.04
Error	2331.15	76	30.67		

B. ANALYSIS OF VARIANCE ON COVARIATE - SEPTEMBER

Source	SS	DF	MS	F	Probability
School	177.02	1	177.02	7.76	0.007
Grade	148.52	1	148.52	6.51	0.01
Interaction	103.51	1	103.51	4.54	0.04
Error	1733.85	76	22.81		

C. ANALYSIS OF COVARIANCE

Source	SS	DF	MS	F	Probability
School	294.19	1	294.19	10.89	0.001
Grade	152.93	1	152.93	5.66	0.02
Interaction	52.64	1	52.64	1.95	0.17
Error	2025.69	75	27.01		

Table LXXXVII, right knee extension, summarizes the results of the analysis of covariance finding a significant difference favoring the control group for the schools with a probability of 0.04, probability of 0.02 showing significance between grades and no significant interaction.

TABLE LXXXVII

ANALYSIS OF COVARIANCE COMBINED GROUPS - RIGHT KNEE EXTENSION

A. ANALYSIS OF VARIANCE ON CRITERION - APRIL

Source	SS	DF	MS	F	Probability
School	787.50	1	787.50	9.25	0.003
Grade	775.00	1	775.00	9.10	0.003
Interaction	90.31	1	90.31	1.06	0.31
Error	6473.19	76	85.17		

B. ANALYSIS OF VARIANCE ON COVARIATE - SEPTEMBER

Source	SS	DF	MS	F	Probability
School	460.75	1	460.75	5.22	0.03
Grade	288.75	1	288.75	3.27	0.08
Interaction	135.25	1	135.25	1.53	0.22
Error	6712.25	76	88.32		

C. ANALYSIS OF COVARIANCE

Source	SS	DF	MS	F	Probability
School	293.11	1	293.11	4.40	0.04
Grade	369.61	1	369.61	5.65	0.02
Interaction	14.78	1	14.78	0.23	0.64
Error	4908.52	75	65.45		

The results of the analysis of covariance for left knee extension (Table LXXXVIII) show no significance in the sources of variation school and interaction, but demonstrate significance with a probability of 0.05 for the difference between grades.

TABLE LXXXVIII

ANALYSIS OF COVARIANCE COMBINED GROUPS - LEFT KNEE EXTENSION

A. ANALYSIS OF VARIANCE ON CRITERION - APRIL

Source	SS	DF	MS	F	Probability
School	594.06	1	594.06	6.27	0.01
Grade	1022.44	1	1022.44	10.79	0.002
Interaction	162.44	1	162.44	1.71	0.19
Error	7202.63	76	94.77		

B. ANALYSIS OF VARIANCE ON COVARIATE - SEPTEMBER

Source	SS	DF	MS	F	Probability
School	632.81	1	632.81	7.02	0.01
Grade	655.50	1	655.50	7.27	0.009
Interaction	56.13	1	56.13	0.62	0.43
Error	6849.06	76	90.12		

C. ANALYSIS OF COVARIANCE

Source	SS	DF	MS	F	Probability
School	80.75	1	80.75	1.27	0.26
Grade	255.34	1	255.34	4.01	0.05
Interaction	68.04	1	68.04	1.07	0.31
Error	4773.28	75	63.64		

Table LXXXIX (leg lift) and Table XC (back lift) summarize the results of the analysis of covariance for both parameters. No significant difference was noted in any of the sources of variation for either parameter.

TABLE LXXXIX

ANALYSIS OF COVARIANCE COMBINED GROUPS - LEG LIFT

A. ANALYSIS OF VARIANCE ON CRITERION - APRIL

Source	SS	DF	MS	F	Probability
School	1361.19	1	1361.19	1.35	0.25
Grade	5644.81	1	5644.81	5.59	0.02
Interaction	1216.38	1	1216.38	1.20	0.28
Error	76742.44	76	1009.77		

B. ANALYSIS OF VARIANCE ON COVARIATE - SEPTEMBER

Source	SS	DF	MS	F	Probability
School	2531.00	1	2531.00	4.00	0.05
Grade	7219.81	1	7219.81	11.42	0.001
Interaction	3001.69	1	3001.69	4.75	0.03
Error	48043.75	76	632.16		

C. ANALYSIS OF COVARIANCE

Source	SS	DF	MS	F	Probability
School	283.75	1	283.75	0.31	0.58
Grade	1534.63	1	1534.63	1.66	0.20
Interaction	2975.94	1	2975.94	3.21	0.08
Error	69443.38	75	925.91		

TABLE XC

ANALYSIS OF COVARIANCE COMBINED GROUPS - BACK LIFT

A. ANALYSIS OF VARIANCE ON CRITERION - APRIL

Source	SS	DF	MS	F	Probability
School	1155.19	1	1155.19	2.54	0.115
Grade	1786.00	1	1786.00	3.92	0.051
Interaction	61.31	1	61.31	0.13	0.71
Error	34598.31	76	455.24		

B. ANALYSIS OF VARIANCE ON COVARIATE - SEPTEMBER

Source	SS	DF	MS	F	Probability
School	76.06	1	76.06	0.32	0.57
Grade	1445.06	1	1445.06	6.04	0.02
Interaction	115.19	1	115.19	0.48	0.49
Error	18186.50	76	239.30		

C. ANALYSIS OF COVARIANCE

Source	SS	DF	MS	F	Probability
School	803.60	1	803.60	2.22	0.14
Grade	297.85	1	297.85	0.82	0.37
Interaction	214.67	1	214.67	0.59	0.44
Error	27148.15	75	361.98		

Statistical Analysis of the Stabilometer

Due to the nature of the stabilometer test somewhat different treatment than that exercised over the other items was required for analysis.

Testing time was limited in each school comprising the sample therefore, it was necessary to randomly select ten grade one subjects and ten grade two subjects from the experimental groups and ten grade

one subjects and ten grade two subjects from the control group. This provided a combined experimental group and a combined control group each with an N equal to twenty.

Table XCI summarizes the September and April learning gain scores for the experimental and control groups plus the means and standard deviations of these learning gain scores.

Each subject's learning gain score was calculated by the formulae:

Learning Gain $= AV_1 - AV_F$

where:

$$AV_1 = \text{Average Initial Score} = \frac{\text{Trial 1} + \text{Trial 2}}{2}$$

$$AV_F = \text{Average Final Score} = \frac{\text{Trial 19} + \text{Trial 20}}{2}$$

TABLE XCI

STABILOMETER

Subject	X_1 Experimental: AVI - AVF Learning Gain September	Y_1 Experimental: AVI - AVF Learning Gain April		X_2 Control: AVI - AVF Learning Gain September	Y_2 Control: AVI - AVF Learning Gain April
1	75	159		233	44
2	404	120		213	150
3	166	559		92	28
4	290	193		736	-16
5	126	217		134	78
6	14	134		308	-26
7	125	143		146	24
8	175	24		45	-140
9	-37	20		81	43
10	152	-5		318	39
11	63	86		245	85
12	-42	112		151	89
13	39	149		373	73
14	62	152		159	89
15	46	63		287	48
16	67	195		269	116
17	7	-37		320	83
18	28	-15		94	85
19	-71	77		406	40
20	-2	69		171	31
Sum	1687	2415	Sum	4781	963
Sum^2	390873	595429	Sum^2	1600943	116613
Mean	84.35	120.75	Mean	239.05	48.15
S.D.	111.402	123.251	S.D.	151.335	59.264
Sum X_1Y_1	284590		Sum X_2Y_2	225250	

For Both Groups

Sum X	6468	Sum Y	3378	Sum XY	509840
Sum X^2	1991816	Sum Y^2	712042		

Table XCII summarizes the results of the analysis of covariance (37:296) applied to the parameter: stabilometer test scores. A highly significant F score of -13.63 is noted to far exceed the required .01 probability level F score of 7.37 for degrees of freedom 1 and 37. Therefore, a significant difference occurs between the April test scores of the two groups.

TABLE XCII

ANALYSIS OF COVARIANCE - STABILOMETER

Source	df	SSx	SSy	SSxy	SSyx	MSyx(Vyx)	SDyx
Among Means	1	-946,285	-249,670	-112,313	-248,022	-248,022	
Within Groups	37	1,892,225	676,440	75,930	673,393	18,200	135
Total	38	945,940	426,770	- 36,383	425,371		

$$Fyx = \frac{-248,022}{18,200} = -13.63$$

From Table F

df 1/37

F at .05 level = 4.11

F at .01 level = 7.37

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

The purpose of this study was to investigate the level of achievement on a battery of physical performance tests by two groups of elementary pupils. One group received instruction using the "problem-solving approach," while the second group received instruction using the direct approach. This study also proposed to investigate the relationship between the problem-solving method of instruction and physical performance; and, the relationship between the direct method of instruction and physical performance. Another purpose of this study was to contribute to the available research of teaching methods as they affect elementary school physical education.

The sample was comprised of boys and girls registered in grade one and two at Windsor Park Elementary School and Grandview Heights Elementary School. The Edmonton Public School Board consented to permit the testing of the grades one and two pupils in the schools selected. Of those pupils tested only those from whom complete test results were available were maintained for study, while all pupils with incomplete results were excluded. To obtain an N equal to 20 for each test group some pupils were excluded from final analysis by random exclusion.

The test items each subject was examined by included:

A. The Strength Chair:

a) right grip strength

b) left grip strength

c) right elbow flexion

d) left elbow flexion

e) right elbow extension

f) left elbow extension

g) right knee extension

h) left knee extension

B. The Strength Stool:

a) leg lift

b) back lift

C. The Stabilometer

D. C.A.H.P.E.R. Fitness Performance Test:

a) one minute speed sit ups

b) standing broadjump

c) shuttle run

d) flexed arm hang

e) 50 yard run

f) 300 yard run

The test period began in September, 1966, and extended to the end of April 1967. During September the initial testing covered a total of four successive days. Following the initial testing the subjects

participated in their regular physical education programs. Four days final testing in April completed the test period which was administered by eleven examiners.

For the main part the analysis was carried out by programs designed for use in the IBM 7040 computer. The statistical analysis for all items excluding the stabilometer included the following calculations:

1. Means, standard deviations and difference in means for each group for each test item in the initial and final test.

2. Within group analysis of variance for each group for each test item.

3. One-way analysis of covariance for each grade for each test item.

4. Two-way analysis of covariance for each item for the combined grades one and two in each school.

5. Reliability correlation coefficients for each item calculated for each class.

6. Zero order correlation for all parameters for each group during the September and April test periods.

The statistical analysis of the stabilometer results included the following calculations:

1. Determination of the September and April learning gain scores.

2. Means and standard deviations of the September and April learning gain scores.

3. t-tests between the learning gain scores of the control and experimental groups in September.

4. Analysis of covariance of the learning gain scores.

5. Reliability correlation coefficients for each group.

6. Graphical representation of the average error score for each trial for the experimental and control group in September and April.

The reliability coefficients determined over the September-April test period for both the grade ones and twos of the control and experimental groups are listed in detail in Appendix C and Appendix E (for the stabilometer). Reliability correlation coefficients ranged between a high of 0.98 for the height variable of the grade two experimental group to a low of 0.01 for the leg lift variable of the experimental group grade ones. For the stabilometer, based upon somewhat different calculations discussed in detail in Appendix E reliability coefficients ranged from 0.55 for the experimental group in September to 0.81 for the same group in April.

It is of interest to note that the analysis of covariance for the grade one pupils of the experimental and control groups demonstrates significance better than or equal to $p=0.05$ in only two variables; the standing broadjump and the shuttle run when the experimental group surpassed the control group. For all other variables examined no significant difference was expressed.

The previous analysis of covariance when applied to the grade two subjects of the sample illustrated somewhat different results. No significant difference was determined in eight of the variables, while ten (all favoring the control group) demonstrated a significant difference.

When the grade one and two pupils of the control groups are combined and compared to a similar grouping of the experimental group seven parameters show no significant difference, nine show a significant difference favoring the control group, two show a significant difference favoring the experimental group and the stabilometer which was analysed only for this grouping illustrates a significant difference favoring the control group.

Conclusions

1. It is concluded that no significant difference in height occurs between the grade one sample groups. For the grade two sample groups height, it is concluded that a significant difference ($p=0.006$) does exist. For the combined groups all sources show significant differences; schools ($p=0.04$), grade ($p=0.02$) and interaction ($p=0.02$).

2. It is concluded that no significant difference in weight occurs between: the sample groups of grade ones, the sample groups of grade twos, nor between the combined grade ones and twos of the control group and the combined grade ones and twos of the experimental group. A significant difference ($p=0.03$) is found to exist between the grade ones and twos.

3. For the parameter one-minute speed sit-ups it is concluded that no significant difference occurs between the grade one control group and the grade one experimental group. However, it is concluded that a significant difference ($p=0.001$) is present for the corresponding groups of grade two. When the grade ones and twos of the control group are combined and compared to the grade ones and twos of the experimental group it is concluded that a significant difference ($p=0.0001$) exists between grades, a significant difference ($p=0.005$) exists for the interaction source and no significant difference occurs between combined groups.

4. Regarding the analysis of the results obtained for the standing broadjump it is concluded that a significant difference ($p=0.03$) exists between the control and experimental groups of grade ones while no significant difference exists between the grade twos. For the combined groups it is concluded that a significant difference ($p=0.02$) exists between schools and also between grades where the probability is also significant ($p=0.001$) while no significant interaction was found.

5. It is concluded that a highly significant difference ($p=0.0001$) exists between the control and experimental groups of grade ones for the parameter the shuttle run while no significance is found between the same corresponding groups of grade twos. For the analysis of the results for the combined grade ones and twos of each group it is concluded that a significant difference is found for all sources of

variation: school (p=0.000), grade (p=0.01) and interaction (p=0.03).

6. It is concluded that for the parameter flexed arm hang a significant difference (p=0.04) exists for only one source of variation, and that is between schools when the grade ones and twos of the control group are combined and compared with the grade ones and twos of the experimental group.

7. For the 50 yard run it is concluded that no significant difference occurs between the grade one groups. It is concluded that a significant difference (p=0.04) occurs on the same parameter for the grade twos. When combining the grade ones and twos of the control group and comparing them to the grade ones and twos of the experimental group it is concluded that a significant difference (p=0.008) occurs between schools and no significant difference occurs in either grade or interaction.

8. It is concluded that no significant difference occurs between the sample groups of grade ones in their ability to do the 300 yard run. It is also concluded that for the grade twos, a significant difference (p=0.04) does occur between their ability to perform the 300 yard run. For the combined grade ones and twos of the control group compared to the combined grade ones and twos of the experimental group the only source of significant difference (p=0.05) is that between grades.

9. With respect to the parameter right hand grip no significant difference is found between the control and experimental groups of grade ones. However, a significant difference (p=0.03) is found between the

grade twos of the control and experimental group. When the grade ones and twos of the control group are combined and compared to the grade ones and twos of the experimental group it is concluded that a significant difference ($p=0.04$) occurs between schools and a significant difference ($p=0.006$) occurs between grades while no significant interaction is found.

10. For the parameter left hand grip it is concluded that no significant difference occurs between grade one sample groups while a significant difference ($p=0.001$) is found to be present between the control and experimental groups of grade twos. When the groups are combined to form grade ones and twos of the control group and grade ones and twos of the experimental group it is concluded that a significant difference ($p=0.001$) exists between schools, a significant difference ($p=0.000$) is found between grades and no significant interaction is found.

11. It is concluded that no significant difference in right elbow flexion strength exists between the grade one sample groups. For grade twos, a significant difference ($p=0.0008$) is found between the sample groups. For the combined grade ones and twos of the control group compared to the grade ones and twos of the experimental group no significant difference is found for the sources of variation school and grade, while a significant difference ($p=0.000$) is found for interaction.

12. Regarding the parameter left elbow flexion strength no significant difference is noted between the grade one groups of the sample, while a significant difference ($p=0.0002$) is found to be present

between the grade two groups of the sample. A significant difference (p=0.006) is concluded to be present between schools when the grade ones and twos of the control are combined and compared to the corresponding experimental group. This combination concluded no significant difference between grades but found a significant difference (p=0.002) for the source of variation interaction.

13. For the parameter right elbow extension strength it is concluded that no significant difference exists between the sample groups of grade ones. However, a significant difference (p=0.00003) exists between groups of the grade two sample. It is concluded that all sources of variation examined when grades in each school are combined, show a significant difference; school (p=0.000), grade (p=0.03) and interaction (p=0,01).

14. It is concluded that no significant difference in left elbow extension strength between the grade one sample groups. For grade twos, a significant difference (p=0.005) is found between the sample groups. A significant difference (p=0.001) is concluded to be present between schools when the grade ones and twos of the control are combined and compared with the corresponding experimental group. A significant difference (p=0.02) is also found between grades for the same grouping while no significant interaction was noted.

15. It is concluded that no significant difference in right knee extension occurs between control and experimental groups of grade ones or grade twos. However, a significant difference (p=0.04) is concluded to exist between schools when grades ones and twos of the control group

are compared with grade ones and twos of the experimental group, and a significant difference ($p=0.02$) is concluded to be present between grades for the same grouping. No significant interaction variable was found to be present for the combined grouping.

16. For the parameter left knee extension it is concluded that no significant difference occurs between the control and experimental groups of grade ones or grade twos. When the grade ones and twos of the control group are combined and compared with the grade ones and twos of the experimental group it is concluded that a significant difference ($p=0.05$) exists between grades while no significant difference was found for the sources of variation school and interaction.

17. It is concluded that for the parameter leg lift no significant difference was found between; grade one sample groups, grade two sample groups or between combined control compared with combined experimental groups.

18. As for the leg lift strength item it is similarily concluded for the back lift strength item that no significant difference was found between; grade one sample groups, grade two sample groups or between combined control compared with combined experimental groups.

19. It is concluded that a significant difference in stabilometer error scores occurs between control and experimental groups beyond the $p=0.01$ level.

Recommendations

1. It is recommended that further study be made of the components required to learn a physical skill.

2. It is recommended that specific study be initiated to determine the effect of methodology upon the learning of a physical skill.

3. It is recommended that elementary school pupils be studied in reference to their attitudes about particular physical skills.

4. It is recommended that the attitudes of pupils toward the method of instruction employed be further examined.

5. It is recommended that further studies be initiated in methods and techniques through which more objective evaluation of curricula and methodology may be attained.

6. It is recommended that the limitations of this study be kept in mind during any interpretation.

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APPENDICES

APPENDIX A

TESTING MANUAL

STRENGTH CHAIR

Item I: Grip Strength Test

The subject is seated in the strength chair with the testing arm flexed as far as possible and holding the Smedley Adjustable Grip dynamometer with the dial facing away.

The hand is in a vertical position and no rotation is allowed during the test.

As the subject begins squeezing, he drops his arm to 90 degrees flexion.

The subject is allowed six seconds for each squeeze during which the tester shouts encouragement.

The subject rests as the score is recorded.

Three trials of the right hand are followed by three with the left hand.

Item II: Elbow Flexion Test

The shoulder and elbow holders are adjusted so that the subject is in a comfortable upright sitting position with the shoulders back and evenly balanced, elbows against his side and adjusted forward or backward so that his upper arm is vertical. The hands are vertical and clinched throughout the test.

A goniometer is used to adjust the elbow to an angle of 120 degrees, and a belt loop is placed over the arm between wristbone and olecranon process.

The cable and chain are snapped to the loop and attached to the adjustable hook at the base of the machine. The hook is adjusted to the perpendicular with the lower arm, so that the angle of pull is straight. A Pacific cable tensiometer is attached to the cable.

The subject flexes against the cable as hard as possible for six seconds. A brief rest is allowed as the score is recorded. Three trials with the right arm are followed by three trials with the left arm. Encouragement is shouted during the contraction phase.

Item III: Elbow Extension Test

The overall position and procedure are the same as for the Elbow Flexion Test with these differences: the elbow angle is adjusted to 90

degrees, the cable and chain are fastened to the V-arm of the testing machine located on the top of vertical pole and the subject extends his arm down against the taut cable.

It is very important that the subject attempts to bend at the elbow rather than push straight down. Encouragement is shouted during the trials.

Item IV: Knee Extension Test

The subject remains in the chair with his hands placed lightly on his legs. A belt loop is placed around the subjects lower leg midway between the malleolus and knee bone. The angle of the knee is adjusted to 120 degrees. The cable and chain are fastened to a hook perpendicular to the lower leg. The tester holds a target in line with the proper angle of pull.

Three trials with the right leg are followed by three trials of the left leg. The shout technique is used during the trials.

STRENGTH CHAIR DATA SHEET

SURNAME	GIVEN NAMES	MONTH DAY YEAR

STRENGTH

	1	2	3	4
RG				
LG				
RF				
LF				
RE				
LE				
RKE				
LKE				

STRENGTH STOOL

Item I: Leg Lift Test

The stool is placed against a flat wall. The subject stands on the stool with feet parallel and shoulder width apart.

The subject grips the metal bar with one hand prone and one supine and with arms bent. Attached to the bar and sent around the subject's back at hip level just over the top edge of the hip bone is a web belt.

The subject's knees are adjusted to an angle of 120 degrees. The Pacific Instrument cable tensiometer is attached. Check to see the subject's back is against the wall.

The subject pulls vertically upward by attempting to straighten his legs.

The subject performs three maximal leg lifts during which he is encouraged by shouting.

Item II: Back Lift Test

The procedure is similar to the leg lift, but the belt is removed and legs are straight throughout the test.

The subject bends slightly at the waist and grasps the bar with straight arms.

The chain and cable are adjusted so with maximal back lift the subject's back is just vertical or touching the wall.

Three trials are allowed during which encouragement is given.

STRENGTH STOOL DATA SHEET

SURNAME	GIVEN NAMES	MONTH DAY YEAR

STRENGTH

	1	2	3	4
LL				
BL				

THE C.A.H.P.E.R. FITNESS-PERFORMANCE TEST

Item I: One Minute Speed Sit-up.

Equipment. Gym mat and stop watch or timer

Starting Position. The subject assumes a back-lying position on the mat, hands inter laced behind his head. The knees are bent and the feet are held flat on the floor by the assistant.

Performance. The subject sits up and touches both elbows to both knees, (or brings them as close as possible). Then he returns to the starting position.

Scoring. The movement sit-up and return is counted as one execution. The total score is the number of complete executions performed in 60 seconds. Allow 1 trial.

Reliability Controls. One examiner kneels straddling the performer's feet. He places his hands on the calves of the subject's legs just below the knee to prevent the subject from sliding away and to maintain the starting position of the legs throughout the test. The second examiner gives the starting signal, encourages the subject to maximal effort and signifies the completion of the test period after the elapsed 60 seconds.

C.A.H.P.E.R. SIT-UP DATA SHEET

______________________	______________________	______________________		
SURNAME	GIVEN NAMES	DAY	MO. DATE	YEAR

NO. OF COMPLETE EXECUTIONS IN 60 SECONDS ______________

THE C.A.H.P.E.R. FITNESS-PERFORMANCE TEST

Item 2. Standing Broad Jump

Equipment. Polyethylene mat, tape measure.

Starting Position. He assumes a position with the feet slightly apart and the toes behind the jumping line.

Performance. Flex at hips, knees and ankles, and using the arms to aid, jump as far forward as possible.

Scoring. Measurement is in terms of inches to the nearest inch from the take-off line to the heel of the foot nearest the take-off line.

Reliability Controls. The suggested take-off angle should be between 30 and 45 degrees. Two valid trials are allowed, the better trial recorded. If any part of the body touches behind the heels, the jump will be considered invalid. Two or three practice trials may be allowed.

C.A.H.P.E.R. STANDING BROAD JUMP DATA SHEET

____________________	____________________	____________________
SURNAME	GIVEN NAMES	MONTH DAY YEAR DATE

DISTANCE TO NEAREST INCH

TRIAL 1: ____________________

TRIAL 2: ____________________

MAXIMUM DISTANCE ____________________

THE C.A.H.P.E.R. FITNESS-PERFORMANCE TEST

Item 3. Shuttle Run.

Equipment. Two wooden blocks (2" x 3" x 3") and a stop watch calibrated to one-tenth of a second.

Starting Position. Lying face down, hands at the sides of the chest, forehead on the starting line.

Performance. On signal, jump to feet and run 30' to the line. Pick up one block of wood, return to the starting line, and place the block behind this line. Return to the second line, pick up the second block of wood, and run back to the finish line.

Scoring. Measurement is in terms of seconds to the nearest tenth of a second from the starting signal until the subject places the second block behind the finish line.

Reliability Controls. The test should be taken in bare feet. A 'ready' warning signal is given prior to the starting signal. Two trials, with a rest between, are allowed and the better trial is recorded.

C.A.H.P.E.R. SHUTTLE RUN DATA SHEET

________________	________________	________________
SURNAME	GIVEN NAMES	MONTH DAY YEAR

TIME

TRIAL 1: ______ . ______ SEC.

TRIAL 2: ______ . ______ SEC.

THE C.A.H.P.E.R. FITNESS-PERFORMANCE TEST

Item 4. Flexed Arm Hang.

Equipment. A doorway gym bar or horizontal bar placed 6' from the floor; a bench and a timer.

Starting Position. The subject reverse grasps the bar (palms toward face) and is assisted in pulling himself to the bar so that his eyes are at the level of the bar. The arms are fully flexed.

Performance. The subject holds himself in this hanging position as long as he is able.

Scoring. The total period of time that the subject can maintain the exact position is determined to the nearest tenth of a second.

Reliability Control. The subject must keep the bridge of his nose at the bar.* One trial is allowed. Tester counts the seconds out loud.

*The subject will be supported by the tester's assistant until the test period is about to begin.

C.A.H.P.E.R. FLEXED ARM HANG DATA SHEET

_______________	_______________	_______________
SURNAME	GIVEN NAMES	MONTH DAY YEAR

LENGTH OF TIME POSITION HELD: _______________ SEC.

THE C.A.H.P.E.R. FITNESS-PERFORMANCE TEST

Item 5. 50 Yard Run

Equipment. A 50 yard straightaway with markers (stakes) placed at the start and finish; a stop watch calibrated to one-tenth of a second; a starting flag.

Starting Position. A racing crouch start or a standing position may be assumed.

Performance. On the starting signal the runner sprints the 50 yard distance.

Scoring. The elapsed time from the starting signal to the passage of the runner's chest across the finish line is scored to the nearest tenth of a second.

Reliability Controls. The test is taken in gym shoes. The subject is encouraged to run in a straight line at maximal speed.

C.A.H.P.E.R. 50 YARD RUN DATA SHEET

SURNAME	GIVEN NAMES	MONTH DAY YEAR

TIME FOR 50 YARDS: ________ . ________ SEC.

THE C.A.H.P.E.R. FITNESS PERFORMANCE TEST

Item 6. 300 Yard Run.

Equipment. Stop watch.

Starting Position. A racing crouch start or a standing position may be assumed.

Performance. On the starting signal the subject runs straight up and around the stake marker and back over the 50 yard straightaway. The circuit is run 3 times to give the 300 yards.

Scoring. The elapsed time from the starting signal to the passage of the runner's chest across the finish line is scored to the nearest second.

Reliability Controls. The test is taken in gym shoes. The subject is encouraged to run in a straight line and corner as sharply as possible (maintaining control).

C.A.H.P.E.R. 300 YARD RUN DATA SHEET

SURNAME	GIVEN NAMES	MONTH DAY YEAR

TIME FOR 300 YARDS: ______________ SEC.

Stabilometer:

Equipment: The stabilometer.

Starting Position. Instruct the subject to step onto the right half (or left half) of the stabilometer with the right foot (or left foot). Then keeping his weight over his right foot (or left foot), place his left foot (or right foot) on the other section of the stabilometer platform. The subject is now standing on the stabilometer, hands on hips and weight over one leg. The timer is set for a 30 seconds trial interval.

Performance. On the signal go, the subject attempts to bring the pivoted board to the horizontal position and keep it there with as little movement as possible.

Scoring. The subject's performance score is recorded automatically in degrees of movement.

Reliability Controls. The test is taken in bare feet. The subject is encouraged to maintain the board in a horizontal (steady) position. There are sixteen trials allowed. Rest periods of 30 seconds are allowed between each trial, during this period the subject remains seated.

FITNESS PROJECT #1

STABILOMETER:

STABILOMETER

	5	10	15	20	25	30	
1							1
2							2
3							3
4							4
5							5
6							6
7							7
8							8
9							9
10							10
11							11
12							12
13							13
14							14
15							15
16							16
17							17
18							18
19							19
20							20
SUM							SUM
MEAN							MEAN

NAME: ______________________

APPENDIX B

GENERAL DATA

APPENDIX B

Sex:	Experimental	Grade 1:	
		a) 8 male	40%
		b) 12 female	60%
	Experimental	Grade 2:	
		a) 10 male	50%
		b) 10 female	50%
	Control	Grade 1:	
		a) 9 male	45%
		b) 11 female	55%
	Control	Grade 2:	
		a) 10 male	50%
		b) 10 female	50%
Handedness:	Experimental	Grade 1:	
		a) 17 R	85%
		b) 3 L	15%
	Experimental	Grade 2:	
		a) 17 R	85%
		b) 3 L	15%
	Control	Grade 1:	
		a) 17 R	85%
		b) 3 L	15%
	Control	Grade 2:	
		a) 18 R	90%
		b) 2 L	10%

APPENDIX C

RELIABILITY CORRELATION COEFFICIENTS

APPENDIX C

RELIABILITY CORRELATION COEFFICIENTS

	Experimental Grade One	Experimental Grade Two	Control Grade One	Control Grade Two
Height	0.92	0.98	0.95	0.93
Weight	0.71	0.95	0.92	0.95
Sit-ups	0.58	0.77	0.68	0.55
Broad-jump	0.72	0.52	0.79	0.70
Shuttle-run	0.68	0.77	0.66	0.79
Flexed Arm Hang	0.42	0.66	0.84	0.30
50 Yard Run	0.75	0.78	0.78	0.47
300 Yard Run	0.46	0.35	0.65	0.38
Right Hand Grip	0.59	0.68	0.37	0.62
Left Hand Grip	0.33	0.64	0.59	0.68
Right Elbow Flexion	0.52	0.32	0.71	0.61
Left Elbow Flexion	0.68	0.08	0.81	0.37
Right Elbow Extension	0.62	0.38	0.47	0.22
Left Elbow Extension	0.37	0.15	0.38	0.48
Right Knee Extension	0.42	0.45	0.60	0.44
Left Knee Extension	0.43	0.64	0.66	0.55
Leg Lift	0.01	0.49	0.20	0.54
Back Lift	0.42	0.27	0.69	0.50

APPENDIX D

ZERO ORDER CORRELATIONS

SEPTEMBER ZERO ORDER CORRELATIONS FOR ALL PARAMETERS OF GRADE ONE EXPERIMENTAL GROUP

	Weight	Sit-ups	Broad Jump	Shuttle Run	Flexed Arm Hang	50 Yard Run	300 Yard Run	Right Hand Grip	Left Hand Grip	Right Elbow Flexion	Left Elbow Flexion	Right Elbow Extension	Left Elbow Extension	Right Knee Extension	Left Knee Extension	Leg Lift	Back Lift
Height	0.12	0.59	0.36	-0.41	0.08	-0.48	-0.23	0.51	0.47	0.33	0.22	0.28	0.30	0.01	0.05	0.36	0.41
Weight		0.03	0.07	0.26	-0.27	0.31	-0.14	0.37	0.54	0.30	0.08	0.06	0.11	0.19	0.29	0.35	0.25
Sit-ups			0.36	-0.26	0.49	-0.40	-0.22	0.67	0.40	0.55	0.44	0.45	0.42	0.21	0.12	0.28	0.46
Broad Jump				-0.61	0.35	-0.54	-0.24	0.51	0.24	0.53	0.30	0.53	0.11	0.14	0.16	0.56	0.62
Shuttle Run					-0.10	0.78	0.41	-0.18	-0.14	-0.06	-0.21	-0.28	-0.19	-0.00	-0.03	-0.48	-0.29
Flexed Arm Hang						-0.32	-0.06	0.33	0.02	0.49	0.37	0.39	0.37	-0.13	-0.01	0.15	0.06
50 Yard Run							0.55	-0.35	-0.07	-0.23	-0.25	-0.46	-0.29	-0.14	-0.31	-0.38	-0.31
300 Yard Run								-0.27	0.08	-0.13	-0.12	-0.06	-0.10	-0.31	-0.44	-0.42	-0.11
Right Hand Grip									0.65	0.66	0.35	0.53	0.45	0.35	0.30	0.42	0.49
Left Hand Grip										0.41	0.16	0.34	0.28	0.26	0.17	0.34	0.39
Right Elbow Flexion											0.70	0.52	0.36	0.32	0.45	0.19	0.52
Left Elbow Flexion												0.45	0.58	0.32	0.52	0.19	0.30
Right Elbow Extension													0.42	0.17	0.28	0.59	0.44
Left Elbow Extension														0.27	0.37	0.33	0.19
Right Knee Extension															0.85	0.06	0.27
Left Knee Extension																0.13	0.26
Leg Lift																	0.51

APRIL ZERO ORDER CORRELATIONS FOR ALL PARAMETERS OF GRADE ONE EXPERIMENTAL GROUP

	Weight	Sit-ups	Broad Jump	Shuttle Run	Flexed Arm Hang	50 Yard Run	300 Yard Run	Right Hand Grip	Left Hand Grip	Right Elbow Flexion	Left Elbow Flexion	Right Elbow Extension	Left Elbow Extension	Right Knee Extension	Left Knee Extension	Leg Lift	Back Lift
Height	0.64	0.52	0.57	-0.41	0.23	-0.54	-0.50	0.54	0.51	0.19	0.26	0.45	0.32	0.51	0.49	0.34	0.30
Weight		0.44	0.26	-0.22	0.23	-0.27	-0.15	0.63	0.66	0.09	0.20	0.53	0.33	0.30	0.24	0.31	0.07
Sit-ups			0.37	-0.61	0.51	-0.68	-0.62	0.26	0.30	0.37	0.35	0.43	0.45	0.51	0.39	0.26	0.18
Broad Jump				-0.58	0.36	-0.60	-0.56	0.48	0.44	0.66	0.35	0.58	0.62	0.45	0.25	0.28	0.52
Shuttle Run					-0.64	0.82	0.65	-0.19	-0.31	-0.57	-0.45	-0.46	-0.56	-0.54	-0.54	-0.56	-0.64
Flexed Arm Hang						-0.59	-0.35	0.50	0.60	0.47	0.30	0.40	0.73	0.53	0.31	0.41	0.09
50 Yard Run							0.74	-0.23	-0.38	-0.48	-0.25	-0.44	-0.59	-0.57	-0.54	-0.48	-0.59
300 Yard Run								-0.13	-0.23	-0.47	-0.37	-0.34	-0.31	-0.66	-0.68	-0.54	-0.57
Right Hand Grip									0.87	0.43	0.33	0.53	0.62	0.38	0.21	0.15	-0.14
Left Hand Grip										0.25	0.08	0.52	0.53	0.36	0.27	0.40	-0.01
Right Elbow Flexion											0.71	0.41	0.76	0.38	0.15	0.04	0.33
Left Elbow Flexion												0.37	0.42	0.38	0.23	-0.05	0.22
Right Elbow Extension													0.69	0.44	0.20	0.28	0.08
Left Elbow Extension														0.54	0.21	0.21	0.14
Right Knee Extension															0.84	0.60	0.37
Left Knee Extension																0.70	0.41
Leg Lift																	0.53

SEPTEMBER ZERO ORDER CORRELATIONS FOR ALL PARAMETERS OF GRADE TWO EXPERIMENTAL GROUP

	Weight	Sit-ups	Broad Jump	Shuttle Run	Flexed Arm Hang	50 Yard Run	300 Yard Run	Right Hand Grip	Left Hand Grip	Right Elbow Flexion	Left Elbow Flexion	Right Elbow Extension	Left Elbow Extension	Right Knee Extension	Left Knee Extension	Leg Lift	Back Lift
Height	0.89	0.45	0.16	0.19	0.06	-0.11	0.20	0.68	0.69	0.39	0.30	0.29	0.33	0.37	0.04	0.56	0.45
Weight		0.32	0.08	0.17	-0.02	-0.08	0.07	0.71	0.66	0.51	0.49	0.45	0.54	0.29	0.01	0.76	0.58
Sit-ups			0.12	0.16	0.40	0.15	0.10	0.29	0.44	0.31	0.09	0.11	0.20	0.36	0.20	0.11	0.01
Broad Jump				-0.31	0.30	-0.56	-0.06	0.52	0.46	0.15	-0.05	-0.01	0.10	0.00	-0.09	0.02	0.20
Shuttle Run					-0.23	0.52	0.23	-0.16	-0.23	-0.17	-0.12	0.03	0.02	0.17	0.01	0.18	-0.07
Flexed Arm Hang						-0.26	-0.21	0.20	0.32	0.04	-0.02	0.07	0.10	0.06	-0.17	-0.19	-0.23
50 Yard Run							0.64	-0.52	-0.44	-0.34	-0.17	-0.28	-0.12	-0.16	-0.08	-0.00	-0.23
300 Yard Run								-0.13	-0.03	-0.21	-0.08	-0.17	0.06	-0.23	-0.11	0.07	-0.08
Right Hand Grip									0.79	0.47	0.39	0.60	0.55	0.14	-0.04	0.53	0.45
Left Hand Grip										0.46	0.29	0.34	0.41	0.21	0.11	0.50	0.44
Right Elbow Flexion											0.63	0.59	0.73	0.43	0.57	0.45	0.46
Left Elbow Flexion												0.62	0.78	0.38	0.38	0.58	0.53
Right Elbow Extension													0.80	0.24	0.23	0.64	0.54
Left Elbow Extension														0.22	0.30	0.65	0.49
Right Knee Extension															0.73	0.33	0.51
Left Knee Extension																0.21	0.37
Leg Lift																	0.88

APRIL ZERO ORDER CORRELATION FOR ALL PARAMETERS OF GRADE TWO EXPERIMENTAL GROUP

	Weight	Sit-ups	Broad Jump	Shuttle Run	Flexed Arm Hang	50 Yard Run	300 Yard Run	Right Hand Grip	Left Hand Grip	Right Elbow Flexion	Left Elbow Flexion	Right Elbow Extension	Left Elbow Extension	Right Knee Extension	Left Knee Extension	Leg Lift	Back Lift
Height	0.85	0.08	-0.15	0.27	0.03	0.08	0.37	0.38	0.23	-0.06	-0.27	0.05	0.15	0.11	0.02	0.40	0.09
Weight		-0.06	-0.24	0.23	-0.12	0.13	0.49	0.48	0.52	0.24	-0.02	0.31	0.39	0.15	0.15	0.46	0.23
Sit-ups			0.07	-0.21	0.48	-0.15	-0.12	0.25	0.12	0.01	0.18	0.20	-0.07	0.45	0.28	0.38	0.33
Broad Jump				-0.54	0.76	-0.42	-0.50	0.40	0.33	-0.05	0.04	-0.07	0.10	0.43	0.30	0.12	-0.18
Shuttle Run					-0.53	0.55	0.38	-0.25	-0.34	-0.08	-0.21	0.03	-0.23	-0.51	-0.23	-0.22	-0.14
Flexed Arm Hang						-0.49	-0.44	0.49	0.23	0.12	-0.00	0.02	0.05	0.57	0.40	0.31	0.04
50 Yard Run							0.69	-0.24	-0.25	-0.12	-0.25	0.14	0.03	-0.29	-0.21	-0.38	-0.25
300 Yard Run								0.00	-0.10	-0.01	-0.18	0.26	0.06	-0.10	0.02	0.17	0.27
Right Hand Grip									0.77	0.28	0.25	0.44	0.59	0.51	0.42	0.48	0.18
Left Hand Grip										0.36	0.41	0.49	0.65	0.53	0.39	0.48	0.17
Right Elbow Flexion											0.62	0.62	0.43	0.35	0.43	0.25	0.38
Left Elbow Flexion												0.77	0.50	0.35	0.56	0.24	0.47
Right Elbow Extension													0.55	0.43	0.64	0.43	0.41
Left Elbow Extension														0.20	0.16	0.18	0.20
Right Knee Extension															0.81	0.54	0.19
Left Knee Extension																0.48	0.25
Leg Lift																	0.67

SEPTEMBER ZERO ORDER CORRELATION FOR ALL PARAMETERS OF GRADE ONE CONTROL GROUP

	Weight	Sit-ups	Broad Jump	Shuttle Run	Flexed Arm Hang	50 Yard Run	300 Yard Run	Right Hand Grip	Left Hand Grip	Right Elbow Flexion	Left Elbow Flexion	Right Elbow Extension	Left Elbow Extension	Right Knee Extension	Left Knee Extension	Leg Lift	Back Lift
Height	0.57	-0.45	-0.10	0.15	-0.17	-0.19	0.12	0.17	0.12	-0.43	-0.33	-0.16	0.03	-0.01	-0.21	0.13	00.13
Weight		-0.61	-0.13	0.16	-0.43	0.20	0.61	-0.02	0.03	-0.19	-0.08	-0.13	0.23	-0.04	-0.28	0.28	0.10
Sit-ups			0.19	-0.30	0.10	-0.30	-0.55	0.14	0.12	0.49	0.43	0.45	0.29	0.08	0.37	0.01	0.10
Broad Jump				-0.57	0.07	-0.38	-0.46	0.47	0.65	0.49	0.60	0.66	0.58	0.51	0.50	0.48	0.37
Shuttle Run					-0.29	0.71	0.66	-0.26	-0.58	-0.50	-0.58	-0.64	-0.44	-0.27	-0.35	-0.19	-0.20
Flexed Arm Hang						-0.31	-0.45	0.26	0.15	0.11	-0.00	0.08	-0.07	0.22	0.39	0.15	0.22
50 Yard Run							0.70	-0.31	-0.38	-0.18	-0.34	-0.37	-0.20	-0.19	-0.42	-0.08	-0.11
300 Yard Run								-0.32	-0.43	-0.25	-0.26	-0.48	-0.12	-0.18	-0.50	0.20	-0.03
Right Hand Grip									0.77	0.17	0.39	0.48	0.51	0.34	0.24	0.54	0.72
Left Hand Grip										0.37	0.53	0.60	0.62	0.31	0.18	0.56	0.52
Right Elbow Flexion											0.80	0.70	0.68	0.46	0.42	0.41	0.35
Left Elbow Flexion												0.62	0.67	0.32	0.30	0.29	0.47
Right Elbow Extension													0.73	0.51	0.45	0.41	0.47
Left Elbow Extension														0.54	0.44	0.74	0.61
Right Knee Extension															0.73	0.43	0.69
Left Knee Extension																0.31	0.30
Leg Lift																	0.51

APRIL ZERO ORDER CORRELATION FOR ALL PARAMETERS OF GRADE ONE CONTROL GROUP

	Weight	Sit-ups	Broad Jump	Shuttle Run	Flexed Arm Hang	50 Yard Run	300 Yard Run	Right Hand Grip	Left Hand Grip	Right Elbow Flexion	Left Elbow Flexion	Right Elbow Extension	Left Elbow Extension	Right Knee Extension	Left Knee Extension	Leg Lift	Back Lift
Height	0.66	-0.45	-0.22	0.53	-0.29	0.06	0.26	0.17	0.14	-0.41	-0.08	-0.08	-0.28	0.08	0.00	0.45	0.33
Weight		-0.61	-0.40	0.55	-0.46	0.07	0.48	0.15	0.08	-0.22	0.02	0.16	-0.04	-0.02	-0.17	0.38	0.05
Sit-ups			0.48	-0.58	0.65	-0.55	-0.47	0.22	0.42	0.38	0.35	0.26	0.40	0.27	0.50	0.04	0.42
Broad Jump				-0.69	0.27	-0.37	-0.53	0.16	0.57	0.38	0.47	0.33	0.16	0.42	0.41	-0.07	0.35
Shuttle Run					-0.61	0.40	0.60	-0.15	-0.40	-0.32	-0.33	-0.16	-0.24	-0.23	-0.35	0.35	-0.01
Flexed Arm Hang						-0.32	-0.53	0.27	0.33	0.28	0.11	0.11	0.27	0.35	0.43	0.01	0.22
50 Yard Run							0.54	-0.36	-0.62	-0.29	-0.54	-0.40	-0.51	-0.17	-0.32	0.06	-0.37
300 Yard Run								-0.31	-0.48	-0.43	-0.37	-0.15	-0.26	-0.25	-0.37	0.24	-0.31
Right Hand Grip									0.53	0.41	0.54	0.41	0.29	0.05	0.09	0.22	0.29
Left Hand Grip										0.56	0.62	0.60	0.56	0.41	0.53	0.25	0.53
Right Elbow Flexion											0.74	0.76	0.73	0.13	0.14	0.27	0.24
Left Elbow Flexion												0.75	0.65	0.16	0.13	0.28	0.33
Right Elbow Extension													0.73	0.32	0.13	0.54	0.49
Left Elbow Extension														0.25	0.24	0.24	0.20
Right Knee Extension															0.80	0.21	0.30
Left Knee Extension																0.07	0.21
Leg Lift																	0.59

SEPTEMBER ZERO ORDER CORRELATION FOR ALL PARAMETERS OF GRADE TWO CONTROL GROUP

	Weight	Sit-ups	Broad Jump	Shuttle Run	Flexed Arm Hang	50 Yard Run	300 Yard Run	Right Hand Grip	Left Hand Grip	Right Elbow Flexion	Left Elbow Flexion	Right Elbow Extension	Left Elbow Extension	Right Knee Extension	Left Knee Extension	Leg Lift	Back Lift
Height	0.86	-0.02	-0.21	-0.07	-0.52	-0.26	-0.07	0.34	0.30	0.26	0.53	0.25	0.47	0.47	0.49	0.44	0.16
Weight		-0.17	-0.37	0.20	-0.61	-0.21	0.20	0.36	0.40	0.32	0.62	0.37	0.48	0.33	0.41	0.43	0.08
Sit-ups			0.63	-0.64	0.34	-0.50	-0.47	0.01	0.04	0.15	0.08	0.18	0.28	0.25	0.25	0.40	0.10
Broad Jump				-0.76	0.33	-0.50	-0.45	0.08	0.21	0.04	0.05	0.13	0.12	0.37	0.22	0.15	0.40
Shuttle Run					-0.31	0.57	0.66	-0.20	-0.27	0.15	0.05	-0.09	-0.19	-0.68	-0.55	-0.30	-0.15
Flexed Arm Hang						-0.13	-0.25	-0.05	-0.14	0.06	-0.16	0.03	-0.14	-0.02	-0.10	-0.19	-0.08
50 Yard Run							0.58	-0.11	-0.38	-0.14	-0.31	-0.41	-0.49	-0.34	-0.47	-0.45	-0.02
300 Yard Run								-0.24	-0.37	-0.14	0.02	-0.20	-0.22	-0.43	-0.38	-0.30	0.12
Right Hand Grip									0.74	0.41	0.47	0.35	0.23	0.46	0.24	0.53	0.09
Left Hand Grip										0.31	0.36	0.40	0.36	0.54	0.48	0.66	-0.07
Right Elbow Flexion											0.62	0.37	0.04	-0.02	-0.13	0.53	0.03
Left Elbow Flexion												0.60	0.50	0.23	0.28	0.46	0.10
Right Elbow Extension													0.80	0.37	0.27	0.30	0.11
Left Elbow Extension														0.48	0.56	0.37	0.23
Right Knee Extension															0.82	0.49	0.35
Left Knee Extension																0.41	0.18
Leg Lift																	0.48

APRIL ZERO ORDER CORRELATION FOR ALL PARAMETERS OF GRADE TWO CONTROL GROUP

	Weight	Sit-ups	Broad Jump	Shuttle Run	Flexed Arm Hang	50 Yard Run	300 Yard Run	Right Hand Grip	Left Hand Grip	Right Elbow Flexion	Left Elbow Flexion	Right Elbow Extension	Left Elbow Extension	Right Knee Extension	Left Knee Extension	Leg Lift	Back Lift
Height	0.87	-0.01	-0.10	0.01	-0.49	0.14	0.35	0.26	0.23	0.51	0.31	0.07	0.46	0.58	0.50	0.34	0.12
Weight		-0.15	-0.18	0.01	-0.61	0.10	0.20	0.36	0.32	0.58	0.34	0.15	0.48	0.39	0.49	0.26	0.24
Sit-ups			0.35	-0.43	0.45	-0.32	-0.23	0.16	0.17	0.06	0.09	0.46	0.37	0.13	0.28	0.36	0.31
Broad Jump				-0.64	0.21	-0.48	-0.42	0.25	0.24	0.39	0.60	0.40	0.40	0.17	0.08	0.43	0.57
Shuttle Run					0.03	0.73	0.66	-0.62	-0.67	-0.23	-0.56	-0.42	-0.29	-0.20	-0.15	-0.35	-0.35
Flexed Arm Hang						-0.13	-0.21	-0.17	-0.34	-0.01	-0.16	0.20	0.02	-0.31	-0.58	0.23	0.06
50 Yard Run							0.53	-0.44	-0.58	-0.16	-0.62	-0.34	-0.41	0.01	0.09	-0.39	-0.42
300 Yard Run								-0.60	-0.48	-0.16	-0.32	-0.37	-0.07	-0.03	0.15	-0.30	-0.25
Right Hand Grip									0.79	0.46	0.43	0.46	0.34	0.14	0.04	0.40	0.20
Left Hand Grip										0.32	0.48	0.47	0.40	0.06	0.12	0.27	0.10
Right Elbow Flexion											0.55	0.35	0.64	0.19	0.14	0.54	0.44
Left Elbow Flexion												0.23	0.62	0.27	0.11	0.61	0.72
Right Elbow Extension													0.68	-0.08	0.02	0.36	0.36
Left Elbow Extension														0.18	0.19	0.56	0.64
Right Knee Extension															0.66	0.20	0.22
Left Knee Extension																-0.03	0.24
Leg Lift																	0.60

APPENDIX E

STABILOMETER RELIABILITY COEFFICIENT

STABILOMETER RELIABILITY COEFFICIENTS

The reliability coefficients were calculated for the September and April test periods for both the experimental and control groups. The basis for calculation was as follows: the X variable was determined as the result of subtracting the trial 19 score from the trial 1 score, the Y variable was determined as the result of subtracting the trial 20 score from the trial 2 score. (X = trial 1 - trial 19, Y = trial 2 - trial 20).

EXPERIMENTAL GROUP SEPTEMBER RELIABILITY COEFFICIENT

$$\text{Sum } X = 2{,}360$$
$$\text{Sum } Y = 1{,}011$$
$$\text{Sum } X^2 = 737{,}278$$
$$\text{Sum } Y^2 = 260{,}771$$
$$\text{Sum } XY = 291{,}113$$
$$N = 20$$
$$r = 0.55$$

EXPERIMENTAL GROUP APRIL RELIABILITY COEFFICIENT

$$\text{Sum } X = 2{,}645$$
$$\text{Sum } Y = 2{,}093$$
$$\text{Sum } X^2 = 670{,}863$$
$$\text{Sum } Y^2 = 567{,}355$$
$$\text{Sum } XY = 548{,}688$$
$$N = 20$$
$$r = 0.81$$

CONTROL GROUP SEPTEMBER RELIABILITY COEFFICIENT

Sum X	=	5,523
Sum Y	=	4,041
Sum X^2	=	2,044,161
Sum Y^2	=	1,316,747
Sum XY	=	1,521,253
N	=	20
r	=	0.80

CONTROL GROUP APRIL RELIABILITY COEFFICIENT

Sum X	=	1,122
Sum Y	=	974
Sum X^2	=	151,150
Sum Y^2	=	148,235
Sum XY	=	116,428
N	=	20
r	=	0.66

APPENDIX F

STABILOMETER LEARNING CURVE

APPENDIX F

STABILOMETER LEARNING CURVE